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A Successful Municipal Electric Light Plant—Lost Street Monuments—Notes and Queries.

The North River Bridge Co., the older of the two corporations organized to bridge the Hudson River at New York, has commenced excavating for one of its anchorage foundations at Bloomfield and Twelfth Sts., Hoboken. Borings are also being made for the foundations of the New Jersey main tower, supplemental to those already made. This North River bridge has a special charter from Congress granting it pecu'iar powers. Its terminus in New York would be near the intersection of 23d St. and Tenth Ave., where the New York anchorage would be located. The bridge would have a clear span of 3,100 ft. between iron and steel towers 580 ft. high. The estimated cost, including land and terminals, is $36,000,000. The work now started includes the laying of a concrete foundation, 8 ft. deep, and concrete backing above that, faced with very susbtantial granite masonry. This masonry will be part of what is to be the adjacent anchorage pit proper, the latter being carried down to the original sandstone formation, 22 ft. below the street level.

The Niagara Falls & Clifton Suspension Bridge Co., at its annual meeting, held on July 9, decided to build a new suspension bridge across the Niagara Gorge, and authorized the acceptance of bids for the masonry required. The new bridge will have a span exceeding 800 ft., and will accommodate carriage and pedestrian traffic and an electric railway.

Track elevation is practically agreed to in Chicago by the Union Stock Yards & Transit Co., the St. Charles Air-Line, the Pittsburg, Fort Wayne & Chicago, and the Western Indiana railway companies. Some modification is asked for in the city's plans, however, and the companies want the right to do all the work at once.

The suits for damages to property during the riots of 1893 which were brought against the city of Chicago by the Michigan Central, the Union Stock Yards Co. and the Indiana State Line Ry. companies, have all been dropped, according to press reports. It is rumored that other railways will take the same course, and thus Chicago may not, after all, have to pay the bill of $2,000,000 or more which the railways centering there presented for damages sustained during the riots.

An underground loop terminal for street and elevated railway lines entering the business district of Chicago is proposed by the Chicago Central Sub-Railroad Co. An ordinance granting the company permission to build its proposed road is now pending in the city council. It is proposed to build four parallel single-track tunnels at a depth of 35 ft. beneath the street surface, and occupying a space about 50 ft. in width, and have all the elevated and street railway traffic in the down-town business district pass through it, leaving the streets clear of railway lines. By the terms of the ordinance the bonded indebtedness of the company is not to exceed the capital actually invested; the brokerage for negotiating the securities is not to exceed 3%; the dividends are not to exceed 7% on the actual investment, and all net profits exceeding this 7% are to accrue to the city, to be held in trust for the purchase of the property at the end of 20 years. The purchase price at that time is to be the actual cost of the work and plant. During construction and afterwards the city's interests are to be looked after by a commission of seven citizens appointed by the directors of the company and approved by the city council. This commission is to have free access to all the company's books, and no action involving the expenditure of more than $1,000 can be taken without its consent. Beyond the apparent desire to guard the city's interests a little more carefully in the terms of the ordinance, there seems to be little more to this scheme than to the dozen or so others of a similar sort which have preceded it.

A large intercepting sewer to carry the sewage of the "South Side" of the city of Chicago into the new Drainage Channel now under construction is contemplated by the Department of Public Works of that city. At present the bulk of the sewage of this district enters Lake Michigan, flowing through three main sewers into a reservoir near the lake at 83d St., from which it is pumped into the lake. Under the proposed system the flow of the sewage will be directed westward, raised by pumping at Halsted St., and conducted to the Chicago River, from which it will enter the Drainage Channel. The plans for the work have not been developed fully as yet, but surveys are now in progress, and it is the intention to get matters in shape for actual construction as soon as possible. Although the construction of the great drainage channel was definitely decided on five years ago, and work has been in actual progress for three years, this is, we believe, the first recognition of its existence by the sewer department of Chicago in laying out new sewerage work.

The leakage of subsoil water into the Weybridge and Oatlands sewerage system, in England, has been lately tested. About 19 miles of sewers were built, at a cost of $220,625, with many miles lying below the subsoil water level along the Thames. By careful gaging the total amount of leakage into the sewers was found to be only 1,440 gallons in 24 hours. This result was obtained by using unusual precautions in making tight joints and by employing iron pipe in places. The sewage is pumped three miles and purified by chemical precipitation, as the system lies immediately above the water-intakes for the London supply. The engineer was Mr. W. H. Radford, of Nottingham.

The most serious railway accident which has been recorded for many weeks was a rear collision of crowded passenger trains on the Grand Trunk Ry. at Craig's Road, Que., July 9, causing the deaths of about 13 persons and serious injuries to at least 25 others. The trains were special excursion trains for Levis, filled with pilgrims who intended to cross thence to Quebec and take the railway to the church at Ste. Anne de Beaupre, Que. The first train stopped at the water tank at Craig's Road, seven miles from Levis, at about 3 a. m., and in a few minutes it was struck by the second train, the engine of which telescoped the rear car of the first train, which was a Pullman car, occupied by priests and persons in charge of the party. Other cars were also wrecked. It is said that the distant semaphore signal had been properly set at danger. The style of signal in general use on the Canadian lines was shown in our issue of Nov. 8, 1894.

The crown sheet of the boiler of the tug "Stevenson," at Buffalo, N. Y., collapsed July 3, and the engineman and fireman were fatally scalded.

A boiler explosion in the Howard Mill, at Howard, S. Dak., on July 2, killed one man and injured five others, three fatally. The building was wrecked.

An explosion of gas occurred in the coal bunkers of the steamer "Barbadian" at Swansea, Wales, July 6, and four men were seriously injured.

Heavy storms have caused considerable damage in the Southwest, land being flooded and bridges and buildings washed out or blown down. The town of Winona, Mo., was almost destroyed by a cloudburst on July 5, 11 persons being drowned, and five persons were killed by falling buildings during a cyclone at Baxter Springs, Kan., on the same date.

Part of the turning gear of the St. Clair St. bridge at Toledo, O., broke on June 26, while the bridge was being opened, and the bridge could not be opened or closed. According to report, the main pinion of the gearing broke. The turning gear had broken down before, and repairs had only just been completed. The gearing is operated by an electric motor, and it is said the failure was due to the sudden strains due to the heavy torque of th emotor.

The boilers of the electric light plant at Cartagena, Colombia, exploded July 2, killing several persons.

An explosion of gas occurred July 6 in the No. 6 mine of the Susquehanna Coal Co., at Glen Lyon, Pa., by which seven men were badly burned and injured, four probably fatally.

A crowded stairway at the grand stand at the Buffalo Driving Park, Buffalo, N. Y., gave way July 4, carrying down with it a part of the stand. About 20 persons were injured, three fatally.

A grade-crossing collision between an electric car and a coal train on the Erie R. R. occurred at Riverside Park, seven miles from Warren, O., July 7, in which one man was killed and six were injured.

A terrible bridge accident occurred at Bristol, Ind., July 4, resulting in injuries to abaut 70 persons, some of whom will die from internal injuries. A large crowd was on the highway bridge over the St. Joseph River watching a boat race, when a section of the sidewalk gave way, throwing a number of persons to the ground and into the river 30 ft. below. The bridge had two iron truss spans of 200 ft., and was built in 1868 by S. De Graff, of Syracuse, N. Y., for the commissioners of Elkhart county. According to press descriptions, it had originally only the roadway between the trusses, but some years ago a 5-ft. sidewalk was added on one side, being carried by beams bolted on to form an extension of the iron floor beams, and these splices gave way, allowing the whole sidewalk of one span to fall. It is also said that the bridge was known to be unsafe, and that efforts had been made to prevent the overcrowding of the structure on the day of the accident.

The reported failure of a water tank at Attica, O., noted in our issue of July 4, turns out to have been a no more serious disaster tha the loss of a few shueets of tin from the roof of the tank. Mr. E. C. Cooke, of Cleveland, O., was the engineer for the new waterworks at Attica, and the Variety Iron Works, of the same city, furnished the tank. Mr. L. L. Sutton is secretary of the water-works trustees.

Formal bids from three companies for a new water supply for Jersey City were given in our issue of July 4. These bids were all for water from the Rockaway River, delivered at high service, 210 ft. above tide, in the present reservoirs. The bids were based upon specifications issued by the city, to which was appended a note stating that all formal bidders might put in such supplemental propositions as they saw fit. Under this invitation the East Jersey Water Co. made five different offers: Under No. 1 it offered water from the Rockaway River at prices ranging from $43 to $22 per million gallons for a supply ranging from 20,000,000 to 50,000,000 gallons a day, delivered through a single pipe line, the city to have the option of buying the works for $7,250,000. No 2 was an offer to pay the city $40,000 a year for all the water not needed by the city under No. 1, until the city requires 40,000,000 gallons a day. No. 3 was for a supply from Little Falls, the company to have use of the present pumping plant of the city, and to deliver water at low service for $35, and at high service for $50 per million gallons. Under this offer a temporary supply could be given in six months from the source proposed in offer No. 4. Proposition No. 4 was for the surplus water now flowing through the Newark supply main, which the company controls to the extent of about 20,000,000 gallons a day. The compensation under this offer would be the same as that named in the previous one, and the service would terminate in a few years. The fifth proposition is by far the most interesting of all, for it places a price upon the water alone—that is, water, land and land damages, and rights of way, the figure being $2,465,000. In addition, under this offer, the company would be willing to construct the necessary works for 20% advance upon actual cost. The informal offer of the Jersey City and the Rockaway & Hudson Water Co.'s were modifications of their formal bids at reduced prices. Of the formal bids given last week that of the East Jersey Water Co. is so much higher than the others as to throw it out of consideration, while of the remaining two, the Jersey City Water Co. offers water by the million gallons at a price much lower than that named by the Rockaway & Hudson Water Co., but the latter concern is willing to sell its plant for more than $2,000,000 less than the Jersey City Water Co.

Bids for a 40-year water-works francnise are wanted by the city council of Butte, Mont., as stated in our advertising columns. Upon the completion of the works, which must be by Sept. 18, 1898, the city will enter into a ten-year contract for fire protection. Not less than 250 hydrants must be provided, with a pressure of 70 lbs. The city has been supplied by a private company since 1883. Mr. A. A. McMillan, City Clerk, should be addressed for detailed information. Mr. F. W. Blackford is City Engineer.

Highway improvements to the amount of $3,000,000 are to be made in Allegheny County, Pa., the money being expended at the rate of about $450,000 per year. The County Commissioners have engaged Mr. Wm. Brown, formerly City Engineer of Pittsburg, to take charge of the work, and the relocation of roads, condemnation of toll roads, etc., are to begin at once.

FREIGHT TRAFFIC ON ELECTRIC RAILWAYS.

With the rapid increase of suburban and country electric railways, and the practice of carrying freight traffic on such lines, a demand has arisen for cars especially designed for this traffic, and several different types of these cars are shown herewith. In an article on "Mail, Express and Freight Service on Street Railways," in our issue of Oct. 18, 1894, it was shown that 62 electric lines were then carrying mails; 35 were carrying express matter and 55 carried freight traffic. The most

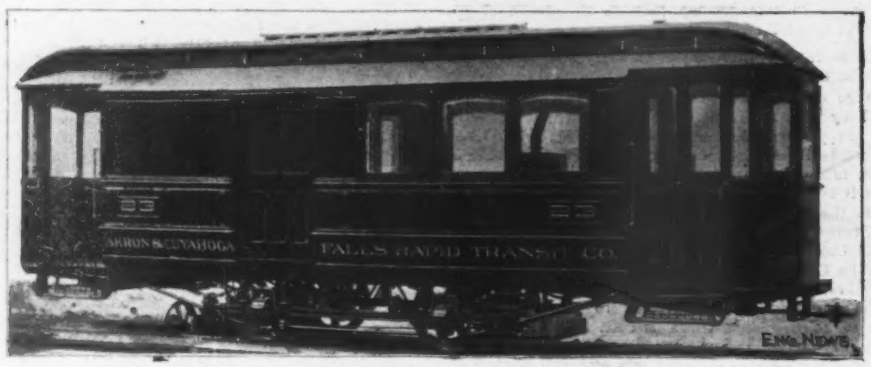


FIG. 1. COMBINATION PASSENGER AND BAGGAGE CAR; AKRON & CUYAHOGA FALLS ELECTRIC RY.

common type of car for such service is a combination car having a passenger compartment and a freight compartment, as it is only in comparatively few cases that it pays to have cars for freight exclusively. With the combination car, mails, parcels and a limited amount of heavy freight may be carried, thus giving a frequent service without running cars any more frequently than is required for the passenger service.

The combination car shown in Fig. 1 was built by the J. G. Brill Co., of Philadelphia, Pa., for the Akron & Cuyahoga Falls Rapid Transit Ry. The body is 20 ft. long, and is divided into two compartments of equal length, one for passengers and one for baggage, while the vestibules are of exceptional size, being 5 ft. long. The passenger compartment is handsomely finished in cherry. The baggage compartment is sheathed to the top rail with oil-finished hardwood. The car is mounted on a Brill rigid motor truck, with coiled bearing springs at the axle boxes and elliptical spring buffers at each end of the frame for overcoming vertical oscillation or pitching of the body, while semi-elliptical springs are used under the axle boxes. The car has the Brill adjustable truss, which prevents sagging of the ends.

Larger cars of this type are carried on two four-wheel trucks. An example is a car built at the same works for the Westminster & Vancouver Tramway Co., of Westminster, B. C. This car is 26 ft. long over the body and 32 ft. long over the platforms, which are open. The width is 6 ft. 10 ins. at the sills, and 7 ft. 6 ins. at the belt rails. The baggage compartment is 8 ft. 8 ins. long, and the passenger compartment 17 ft. 4 ins. long, with a seating capacity for 24 persons. This car is carried on two Brill "maximum traction" trucks of the pattern illustrated in our issue of Jan. 24. The car weighs about 11,050 lbs, the body weighing 5,850 lbs. and the two trucks 5,200 lbs. The J. G. Brill Co. has built about 100 cars for this class of service.

The McKeesport, Duquesne & Wilmerding Ry., which forms a connection between the Pennsylvania R. R. at Wilmerding, Pa., and the manufactories and railways of McKeesport, operates combination cars, box freight cars and open trail cars for carrying vegetables to market. These cars were built by the New Castle Car Mfg. Co., of New Castle, Pa., and one of the open cars is shown in Fig. 2. It is 26 ft. long over the platforms, 18 ft. long over the body, has removable sides 4 ft. high, and is mounted on a McGuire truck. For shipments of heavy freight a box car of 12 tons capacity is used, equipped with two 40-HP. Westinghouse motors. The car is the same length as the open car, 7 ft. high inside, has sliding doors in the sides and ends, and is carried on a McGuire truck. There is also a train of trucks for hauling lumber, sand, bricks, theatrical scenery, etc. This railway is only 4½ miles long, but it effects a connection over a ridge where no route for an ordinary steam railway is practicable, and the existing main lines form a circuitous and indirect route. Passengers on the Pennsylvania R. R. for McKeesport were formerly compelled to go to Pittsburg, change to the Baltimore & Ohio R. R., and then return to McKeesport, making 29 miles of travel from Wilmerding. The height of the ridge is 1,200 ft., and the electric railway surmounts an elevation of 400 ft., having numerous curves and maximum grades of 11%. This electric line is now the principal connecting route, and mail and express matter from the Pennsylvania R. R. arrives in McKeesport five hours earlier than formerly, while a day is saved in freight shipments from the East, as McKeesport merchants have their freight shipped to Wilmerding and then transferred to the electric railway. Mail is carried from the Pennsylvania R. R. over this electric line not only for McKeesport, but for transfer to three lines of steam railway centering at McKeesport. The time from Wilmerding station to the McKeesport post office is 40 minutes, and the mail is carried under the regular railway mail contracts, the government paying a certain amount per 100 lbs. per mile. This was the first electric railway with which the Adams Express Co. made a contract, and the express matter is ordinarily carried on the combination baggage and passenger cars, except when the shipments are large enough to require the use of the box car. For this service the railway company is paid monthly at a certain rate per 100 lbs. of matter.

A combination car leaves each end of the line hourly from 6 a. m. to midnight, the trip occupying about 40 minutes. These cars are 20 ft. long, having a 5-ft. compartment for mail and express matter, this compartment having wide swinging doors. These cars and the ordinary passenger cars are equipped with two 25-HP. Westinghouse motors. All cars are fitted with track brakes for additional safety on the heavy grades. This brake consists of a shoe between the two wheels. The mail, express and freight traffic is a profitable feature, as it does not interfere with the regular passenger service, and the frequency with which the electric cars are run makes the saving in time specially desirable for mail and express matter. At McKeesport the company has its own wagons to collect and deliver freight. Connection is made at this place with electric lines to Reynoldstown, Duquesne and Homestead, while at Wilmerding connection is made with other electric lines extending to Braddock, Glenwood and Pittsburg, so that there is a continuous electric railway route from McKeesport to Pittsburg, 20 miles. All the line is single track, with turnouts, and the track is laid with 52-lb. T-rails on chestnut ties spaced 36 ins. c to c. The power house is situated at about the middle of the line. Coal is obtained from a neighboring mine, owned by the company. Taylor, Romine & Scott, of McKeesport, were the engineers of this road, and we are indebted to Mr. James L. Devenney, its General Manager, for information concerning it.

The large freight car shown in Fig. 3 is a baggage and freight car used on the Rockland, Thomaston & Camden Ry., of Rockland, Me. The body is 25 ft. long, 7 ft. wide and 7 ft. high at the center. The length of platforms is 30 ft., and the distance c. to c. of bolsters 18 ft. 9 ins. The car was built by the Briggs Carriage Co., of Amesbury, Mass., and is carried on two four-wheel Bemis trucks, with a 25-HP. General Electric motor on each axle.

The West Chester Street Ry. Co., of West Chester, Pa., is another electric line doing a freight business. The company operates as one of its branches a cross-country line five miles long, from West Chester to Lenape, built on land acquired by the company. At Lenape freight transfers are made with the Wilmington & Northern R. R., connecting with the Baltimore & Ohio R. R., and large quantities of local freight are brought from Philadelphia in this way, thus competing with the Pennsylvania R. R. for all store goods coming into the town. The freight traffic is considerable, and is expected in time to pay very well. The line is 5 ft. 2½ ins. gage, equipped with the Edison system, and has 5 passenger cars, 1 baggage car and 1 gondola car, all built by the J. G. Brill Co., of Philadelphia. The latter cars carry all kinds of freight except live stock. The U. S. mails are carried between West Chester and Lenape for points on the Wilmington & Northern R. R., and the road has a contract with the United States Express Co. to carry all its business to and from West Chester, for which traffic the baggage car is used.

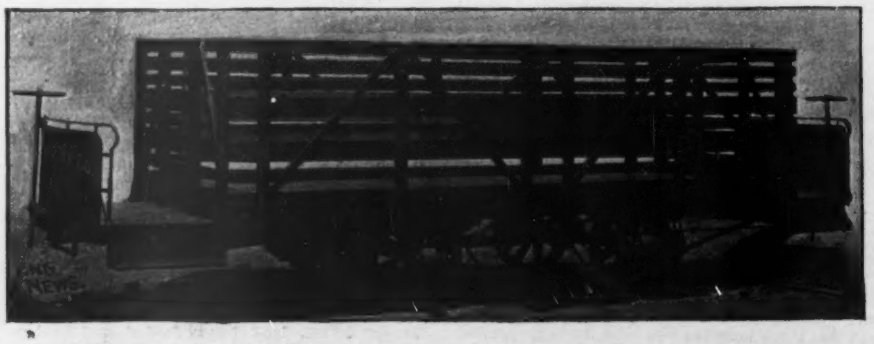


FIG. 2. TRAIL CAR FOR VEGETABLE TRAFFIC; MCKEESFORT, DUQUESNE & WILMERDING ELECTRIC RY.

Two cases may be mentioned in which accommodation is provided for special traffic on electric lines, one being the handling of whisky at Frankfort, Ky., and the other the handling of grain and flour at Spokane, Wash. The Capital Ry., of Frankfort, Ky., does a large business in carrying to the station of the steam railway the barrels of whisky from large distilleries in the district, and

uses for this purpose a large box car, which also carries general freight and supplies for local service, and is used as a locomotive, hauling three loaded box cars between the railway and the distilleries. The car, which was built by the Barney & Smith Co., of Dayton, O., is 28 ft. long over all, 22 ft. 5 ins. long over the body, 8 ft. 4 ins. wide over the sills, 7 ft. 10 ins. high from sills to top of roof and 10 ft. 8 ins. high from rail to top of roof. The platforms are open. The car is mounted

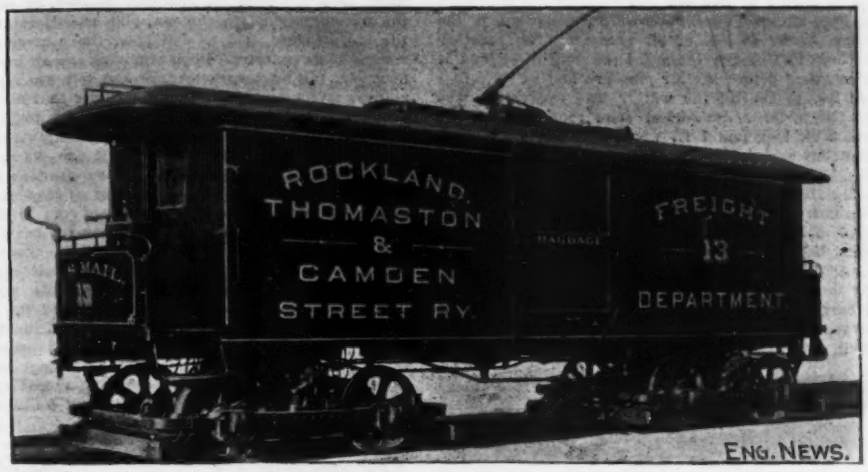


FIG. 3. BOX CAR FOR EXPRESS AND FREIGHT TRAFFIC; ROCKLAND, THOMASTON & CAMDEN ELECTRIC RY.

on a pair of four-wheel trucks, with a 25-HP. motor on each axle, and weighs about 15 tons empty. The line runs through a difficult country and has maximum grades of 8%, with, in one case, a reverse curve on a 7% grade, which, however, the motor car can pass with two or three loaded railway box cars. The track is of 56-lb. T-rails.

The Spokane Street Ry. Co., of Spokane, Wash., hauls wheat and flour between the mills and the railway station, and has displaced the drays formerly used. The city passed an ordinance providing that the charge must not exceed 20 cts. per ton, or

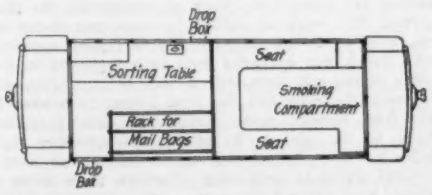


Fig. 4. Plan of Mail Car; Atlantic Ave. R. R.

15 cts. per ton each way if the car is loaded both ways; the minimum car load to be 5 tons, and the company to supply current and right of way over its tracks for any cars owned by the mills at a charge not exceeding $2 per car. The first car was built at the railway company's shops, and is of the ordinary type of box car for electric railways, but having enclosed or vestibuled end platforms. It is 20 ft. long over all, and the grain compartment is 12 ft. long, 6 ft. wide and 5 ft. 6 ins. high, with a capacity of 12,000 lbs., or 200 bushels of wheat. The compartment has side openings, fitted with grain doors. The floor is the same height as that of a railway box car, and underneath it is a steel hopper, the floor being hinged so as to uncover the hopper when raised. At the freight station the floor is raised and the car loaded with grain from the main line cars. On reaching the mill the car is run over a chute, the gate of the hopper is opened and the grain is dumped. The floor is then let down to cover the hopper and the car is loaded with bags or barrels of flour to go to the railway station. The car has also been used for carrying and discharging broken stone for macadamizing the streets along the line. It is mounted on a four-wheel Brill truck with 30-in. wheels and 6 ft. 6 ins. wheelbase, and has an Edison double reduction motor on each axle. The line has grades of 4½ and 5%, and has a curve of 55°.

In mail service one of the most interesting cases is the Brooklyn and Coney Island service of the Atlantic Ave. R. R., Brooklyn, N. Y., for which two cars have been built at the company's shops in accordance with designs prepared by the officers and the post office authorities. They are 28 ft. long and resemble ordinary passenger electric cars, but are divided into two compartments, which have no intercommunication, as shown on the plan, Fig. 4. One is a smoking compartment with seats against the sides and the partition, and the other is a mail-sorting compartment, fitted with sorting table, pigeon holes, racks for bags, and two drop boxes. The ends have double doors, the door of the off side being fastened, and a movable section of seat fitted against it. The cars run from the Brooklyn post office (into which a spur track has been laid from the Adams St. line) to the union station at 36th St. and Fifth Ave., and then over the Brooklyn, Bath & West End Ry., which has been converted from steam to electric traction. The cars run to Coney Island, serving seven or eight intermediate suburban towns, mail bags being delivered and collected at these places. The mails are sorted during the trip, and letters can be posted in the drop boxes on the car.

In Mexico and Central and South America freight traffic is very commonly handled on the street railways, as connections with the steam railways, and as feeders between outlying towns and the steam railways, the cars being drawn by horses or mules. Box, flat and gondola cars are used, mounted on street car wheels and trucks. Figs. 5 and 6 represent two cars of this kind built by the John

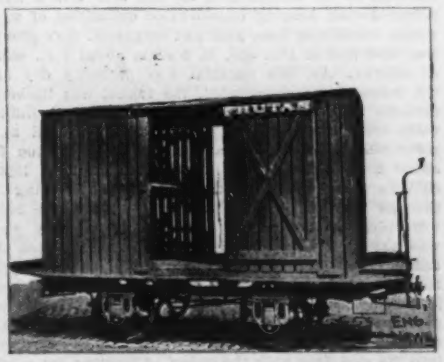


Fig. 5. Street Car for Fruits and Vegetables; Aguascalientes, Mexico.

Stephenson Co., of New York city, which does a large business in this line. Fig. 5 is a slat-sided box car for fruit and vegetables at Aguascalientes, and Fig. 6 is a flat car on the Campeche & Calkin Ry.

THE CONSTRUCTION OF THE EAST RIVER GAS TUNNEL.*

By Walton I. Aims.

During 1891 and 1892 the East River Gas Co., of Long Island City, a corporation with works situated on the Long Island shore of the East River, obtained from the New York State Legislature a new charter, and such necessary legislation as to permit the extension of their mains across the East River into the city of New York.

The feasibility of constructing a tunnel under the river through which the gas mains might be laid was discussed, and after some preliminary surveys and examinations a route was decided upon from the works of the company at Ravenswood, Long Island City, to between 70th and 71st Sts., New York, passing under Blackwell's Island and the east and west channels of the East River. On about this line of location some eight or ten pipe soundings were made in the two river channels, all of which indicated a rock bottom; and the results of these, together with surface indications, where at both the Long Island and New York shores, as well as on Blackwell's Island, bedrock lay exposed, led all to conclude that nothing but rock was to be encountered. On these investigations a contract was entered into on June 25, 1895, for the construction of a supposedly rock tunnel, which the contractor guaranteed to complete by April, 1893.

Work was begun at the Ravenswood or Long Island side on June 28 by sinking a shaft 9 ft. square about 200 ft. back from the river to a depth of about 148 ft. below the surface; while at New York, on July 7, a shaft of the same dimensions was sunk to a depth from the surface of 139 ft. In both these shafts rock was entered after about 8 ft. of soil; but while the rock at New York was quite dry, at Ravenswood it proved seamy and very wet.

The tunnel-roof grade had been established at 109 ft. below mean high water at the New York shaft, with a grade for drainage of ⅛% towards Ravenswood. This gave a minimum cover of 41 ft. at the deepest point in the west or New York channel of the East River, where there is 70 ft. of water at mean high tide. The east or Long Island channel is comparatively shallow, the deepest point being only 35 ft. below mean high water level. The one thing feared was that fissures yielding large volumes of water

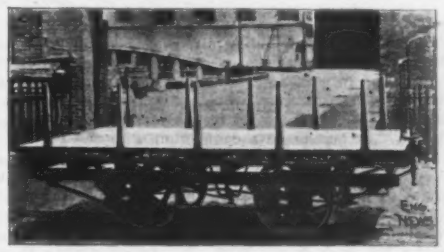


Fig. 6. Flat Car; Campeche & Calkin Ry., Mexico.

might extend to the tunnel roof and largely augment the cost of pumping. The size of the tunnel section was to be 8 ft. 6 ins. in height by 10 ft. 6 ins. in width, this giving sufficient room for the laying of two 3-ft. gas mains and one 4-ft. main.

In the shafts, on both sides of the river, the headings were now turned. At Ravenswood the work was delayed by meeting considerable quantities of salty water, but at New York the tunnel was practically dry until towards the end of December, 1892, when, at a distance of 338 ft. from the shaft, a fissure was struck yielding about a 3-in. stream of salt water. The rock to within 20 ft. of this point had been the regular hard New York gneiss, with a dip towards Long Island of 10° from the vertical, and a strike north and south at right angles to the direction of the tunnel. Here it gradually began to soften, becoming more and more micaceous until when about 20 ft. beyond the water-bearing fissure the rock suddenly terminated, running into a vein of soft material with the same dip and strike as that of the rock.

This new material proved to be a vein, principally of decomposed feldspar, gray in color, crumbling easily, and with no perceptible grit. It still preserved a rock structure, and was perfectly dry when undisturbed. But its exposed surfaces were quickly acted upon by water, which it would absorb and then wash away quite rapidly. The water-bearing fissure and this soft vein were connected; more water was also met at the junction of the rock and the soft material, and later experience proved that in passing through these soft veins water was always to be found

* A paper read before the Boston Society of Civil Engineers, and published in the "Journal of the Association of Engineering Societies" for May, 1895.

next to the rock—a sort of water-course on both sides of the soft vein. Had it not been for encountering this water, the tunnel might have been carried through the soft material without employing compressed air, though the prudence of attempting this might be questioned, for nothing more insures the safety of both the men and the work than compressed air in sub-aqueous tunneling.

The finding of this soft material, so unexpected, was quite a set-back to all concerned. However, it was decided to drive a small timbered drift about 4 ft. wide by 6 ft. high to investigate the ground ahead and find how much of this material was to be penetrated before solid rock was again met. This drift was started and driven in for about 6 ft. Meanwhile a most destructive action was going on between the water and the soft material. The water running along the face of the rock had washed out a cavity overhead in the soft ground. The walls of this cavity were gradually breaking away, and the clay-like substance falling down would close the outlet of the water into the tunnel. The water would then accumulate in this pocket, softening up fresh material on the sides until it had gained a sufficient head to burst through the dam which confined it, when it would come rushing into the tunnel, carrying with it large quantities of the softened material. These rushes were accompanied by a loud bubbling sound that quite mystified the men, which was, of course, the sound of the air displacing the water in the cavity. As soon as the pocket had emptied itself, for a time the trouble was over, until with the falling of more material the outlet was again closed and the operation was repeated. These rushes of water, with the accompanying sound of the bubbling air, soon became more and more alarming to the men. The cavity was constantly increasing in size, and extending up toward the river-bed. Each recurrence would now send the men running for the shaft, by no means certain that the river had not at last made a connection with the tunnel.

All work in the small drift was abandoned, and on Dec. 31 a bulkhead was hurriedly constructed at the face to prevent the threatened flooding of the shaft. Up to this time over 25 yards of material had been washed into the tunnel, all of which had come from along the rock face. With the river-bed only 45 ft. above the tunnel roof, there is every reason to believe that this bulkhead was put in none too soon, and a connection with the river narrowly averted. The bulkhead was well packed with hay to prevent, as much as possible, further washing of the material, and a discussion was now entered into as to the method of future procedure. The contractors were in favor of abandoning the heading and returning to the shaft, to sink to a lower level and start anew in hopes of meeting more favorable conditions at a greater depth. There had been a somewhat similar experience on the Croton Aqueduct, where that tunnel passes under the Harlem River. Soft material had been encountered on the first established level, which proved so troublesome that after two or three unsuccessful attempts had been made to pass through it, it was finally decided to abandon the heading and return to the shaft, sinking some 150 ft. deeper. On this new level nothing but rock was encountered. In the East River tunnel, however, the soft material was clearly a decomposed vein, and to what depth this decomposition might extend was unknown; so that as there were no well-founded reasons, in this case, for expecting any better conditions at a lower level, it was decided to first attempt to drive the present heading, in compressed air, leaving the sinking as a later expedient should the proposed means fail. An arrangement was made with the contractors by which the company was to share the expense of the work in soft ground.

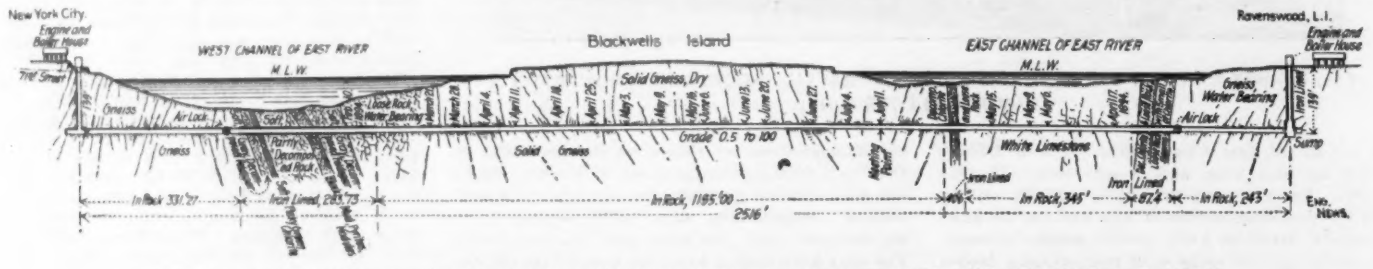
It was at this time that the writer became connected with the work, having charge of installing and conducting the compressed air operations for the company. To form the compressed air-working chamber, a solid brick wall or bulkhead 8 ft. thick was built across the tunnel into gains in the rock about 40 ft. back from the heading, and containing a cylindrical steel air-lock 6 ft. in diameter and 10 ft. long.

In the engine room, the 18 × 24-in. Ingersoll piston-inlet compressor, used heretofore for running the rock drills, was supplemented by a small Rand compressor, and both arranged to supply, independently, compressed air to the working chamber below. Incandescent electric lighting was introduced into the tunnel, which is almost a necessity in compressed air operations, as common illuminants produce an enormous quantity of smoke, when burning in compressed air. A telephone was also taken into the working chamber, by which instant communication could be had with the engine room in case any sudden increase of air pressure should be desired.

On Feb. 25, 1893, operations were commenced, in the heading, under 35 lbs. of air pressure. The previous work here had greatly increased the difficulties, and it was not long before the air pressure had to be raised to 42 lbs. to control the water. The excavation was advanced under a cylindrical steel roof, built up of plates 3 ft. long and 1 ft. wide, of ⅛-in. sheet steel, to the four sides of which were riveted angle bars 2½ × 2½ × ¼ in. These plates were bolted together in a heading about 6 ft. high. In the erection of this roof, poling boards were used for each plate, and a bulkhead carried down with each ring as erected. When the heading had been advanced about 20 ft. from the rock, a 12 × 12 in. yellow pine mudsill was introduced along the bottom of the heading, and on this the roof was carried by means of radial timber bracing. The excavation was now carried down on both sides of this mudsill, to a distance of about 10 ft. from the rock, the steel roof being extended well down on the sides. A circular section was thus excavated, in which brickwork was laid, four courses thick, and with an interval diameter of 10 ft. Between March 4 and 6 a great deal of trouble was experienced. Air pressure was several times to 48 lbs., and the work progressed very slowly on account of the many inrushes of water, and softened material. It was not until April 8 that the last section of brickwork in the soft material was completed, and rock again entered, after passing through 29 ft. of this decomposed material. Of the material met in driving through this vein, at first 9 ft. of the gray decomposed feldspar was penetrated, a vein of 4 ins. of hard quartz was then met, and this was followed by 6 ft. of pure white decomposed feldspar, smooth and soft as plaster. The remaining 14 ft. was made up of layers of feldspar and chlorite. This chlorite, deep green in color, flaky and grease-like to the touch when wet, proved to be very troublesome material, as it was easily converted into a fluid state by the water, which was again encountered next to the rock.

At the Long Island shaft, the work up to this time had progressed to about 250 ft. from the shaft. The material so far encountered on this side was a hard, seamy gneiss, bearing considerable quantities of salty water, containing iron, lime and magnesia. Soft ground was now met at this end, in a seam about 4 ft. wide, of chlorite. As this material was perfectly dry and not thoroughly disintegrated, the tunnel was timbered through this seam without difficulty. Several similar veins were thus met and passed through, until at a point 285 ft. from the shaft, where after drilling for about 2 ft. through rock, a soft green, almost liquid chlorite vein was struck, which began flowing in through the drill holes with great force. These holes were plugged, but as it was necessary to know what was ahead, and as with 100 ft. of cover between the tunnel roof and the river bottom it was thought that the condition of affairs could not be very serious, it was decided to continue driving ahead without air pressure, and with a timbered heading. To see what the material would do, several hand-holes were put into the rock-face with the object of blasting out a hole about 2 ft. square through the remaining 2 ft. of rock, to the chlorite. Before blasting, however, the precaution was taken to build a bulkhead, some 40 ft. back from the face. On firing the holes, an inrush of many yards of material took place, which was finally checked by some rock fragments closing the opening through the rock. After several desperate attempts on the part of the contractors to control this material and make progress, the work was finally abandoned in the latter part of March, and as a 4-in. stream of water was now flowing from the heading, pumping was discontinued, and the shaft and tunnel allowed to flood.

At the New York end, work was still being carried on in compressed air. The rock encountered at the other side of the soft seam closely resembled the decomposed material which had been penetrated before, and consisted of alternate layers of feldspar and chlorite with an occasional vein of quartz. It was quite soft, though requiring drilling and blasting, and eventually it had to be lined. After the heading had been driven about 69 ft. into this rock the company decided, in spite of the uncertainty as to the material ahead, to remove the air pressure, and to call upon the contractors to resume their contract. Upon removing the air-pressure, however, the brickwork through the soft seam proved so unsatisfactory in excluding the water that air-pressure was again put on, and it was decided to line the brickwork with a circular cast iron lining. Although this brickwork was only 10 ft. in inside diameter, a lining was designed 10 ft. 2 ins. in the clear, as it was now desired to make the tunnel bore as large as possible. To put in this lining, some of the brickwork had to be cut out, which was then removed in sections, enough for one ring of plates at a time. The lining consisted of rings of plates or segments, each segment being about 3 ft. long and 1 ft. 4 ins. wide, with internal flanges 4 ins. deep, from the back of the plate. The metal in both the back of the plate and the flanges was 1¼ ins. thick. All the joint-faces of the segments were planed and 1-in. bolts used for fastening them together. A complete tunnel ring was composed of nine segments and a small inverted key, about 8 ins. wide.



PROFILE OF THE EAST RIVER TUNNEL, SHOWING MATERIAL PENETRATED AND PROGRESS OF WORK.

Difficulties between the company and the contractors, which had been brewing for some time, now culminated and the courts were appealed to to settle their differences. This caused a cessation of work for a short time until the company were empowered to take possession and resume the work of construction for themselves. The work of putting the cast iron lining into the brickwork was necessarily a very slow operation. The lining was extended well into the rock on both sides of the soft vein, and a wall built at both ends between the rock and the iron lining, to confine the Portland cement grout which was now introduced back of the plates. To effect this grouting 1¼-in. holes had been drilled and tapped through the back of several plates in each ring. Through these holes the grout was pumped by means of a Cameron pump, and after the space between the brickwork and the lining had been thoroughly grouted, the work was found, on taking off the air pressure from the heading, to be perfectly water-tight. It was not until towards the end of July that the work of lining the brickwork was completed and driving ahead in the rock was resumed. Then, when an advance of only 10 ft. had been made, a second soft seam was encountered about 80 ft. beyond the first one, and a test pipe was driven to a horizontal depth of 70 ft., without encountering anything solid. To avoid further delay the driving of the test pipe was discontinued at this depth and preparations made for advancing the heading. For this test pipe 1½-in. common wrought iron pipe was used, which was driven in by a small machine-drill and washed out at each lengthening of the pipe with a ¼-in. wash pipe. From these washings the different materials penetrated were sampled, with the following tabulated results:

3 ft. gray decomposed feldspar and chlorite.
11 ft. soft black mud, containing lumps of carbonized wood like charcoal.
10 ft. hard black mud and sand, with nodules of pyrites.
22 ft. gray decomposed feldspar.
4 ft. decomposed feldspar and chlorite.
11 ft. gray decomposed feldspar.

Water was again found next to the rock, but was considerably held in check by the compressed air. As from the results of the test pipe there were no special difficulties to apprehend from the indicated material, it was decided to drive ahead, under the open heading method, as this involved no delays in waiting for special machinery. The light steel cylindrical roof was

again used in advancing the excavation, but for the permanent lining the cast iron rings were to be introduced instead of brickwork, as heretofore. A start was made on Aug. 7 to drive the heading into the soft material, but two days later, after the work had been advanced 6 ft. into the soft vein, orders were received to suspend all work on account of the great financial depression of the time. This was unfortunate; and could it have been anticipated a few days the heading into the soft material would have been left unopened. As it was now, from being first disturbed and then abandoned, the water was allowed to soften up the black mud in the heading, and, in spite of the bulkhead, a considerable quantity of the material was washed into the tunnel.

This stay of proceedings was utilized by making a horizontal test boring in the heading on the Long Island side. At this shaft, no work had been done since the departure of the contractors beyond the building of a brick bulkhead and air-lock in the tunnel. Compressed air had then been put on, which considerably reduced the amount of water flowing into the tunnel from the heading. The action of the compressed air had been somewhat peculiar, for notwithstanding the great depth of the tunnel below the river bed, at 10 lbs. pressure the air began to escape through the heading, and with a pressure of 35 lbs. per sq. in. small bubbles of escaping air could be seen rising to the surface for over 300 ft., up and down the river. This seemed to indicate that the ground above the tunnel had been honeycombed up to the river bottom by the previous washing-in of such quantities of the soft green chlorite. As it was known that there were detached lumps of rock in this soft vein, 2-in. heavy pipe was used for the test boring, with drive-well couplings, and a circular, hollow steel bit for the cutting end. This pipe was driven in the same way as the one on the New York side, and after passing through chlorite and various kinds of soft rock fragments, solid rock was again met at 32 ft. Into this rock a hole was drilled to a depth of 54 ft., using a small bit on the end of a 1-in. pipe and drilling through the test-pipe. The rock beyond the soft seam was a soft white limestone.

With the prospect of resuming work the question now arose as to the best method of proceeding; and, as a great deal depended upon the success of driving through the present headings, it was strongly recommended that the safest and surest method, that of shield-tunneling, be adopted in both headings, although necessarily entailing a large expenditure in plant, and delay in time for installation. This plan met with the company's approval, and a shield and hydraulic plant were designed. As the nature of the material to be penetrated beyond the test-pipes was unknown, this shield was so made that in passing from rock to soft material, or back again to rock, it could be erected or taken apart again with a minimum of time and labor, so that it might almost be called a portable shield. As in both the tunnel-headings there was but one air-lock, and as it was inadvisable to remove the air-pressure from the headings, the different parts of the shield had to be of such size as could be passed through the air-lock doors. This was accomplished by dividing the shield transversely, separating the tail-end section, or that which overlaps the tunnel, from the cutting-edge section containing the working chambers. These two sections were, of course, circular, 11 ft. ⅝ in. outside diameter. The tail-end section was 3 ft. 6 ins. long, and the cutting-edge section 3 ft. 8 ins. long. Both of these sections were again divided, longitudinally, into four quadrants. The outside shell, in both tail-end and cutting-edge sections, was made up of one ½-in. and one ⅜-in. steel plates riveted together, and at the four quadrant joints, there were ½-in. butt-straps 12 ins. wide running the whole length of the shield and uniting the quadrants and the two sections. The middle diaphragm, separating the cutting-edge and tail-end sections, was made of two plates, one riveted to each of the two sections, and these two plates bolted together with the butt-straps united the sections. The cutting-edge section contained two platforms, one vertical and one horizontal, of the same length as the section.*

To erect this shield the only riveting necessary was at the four butt-strap joints in the tail-end section, where it was necessary to preserve a flush surface on both sides of the outer shell. In the cutting-edge part countersunk bolts were used through the butt-straps. About 380 ⅞-in. bolts and 160 rivets were used to erect the shield. Two doors closing each of the four working chambers were hung on the vertical platform, and were provided with fastenings so that the whole face could be easily closed.

To drive the shield 12 5-in. hydraulic jacks were used, designed for a working pressure of 5,000 lbs. per sq. in., or 600 tons on the whole shield. These jacks were controlled by two block-valves, one placed on each side of the shield. Each of these block-valves consisted of six independent valves all in one compact casting, each of which had a pressure and exhaust stem. Half-inch XX pipe was used for connecting each jack with its valve, and 1-in. hydraulic pipe was used for the pressure-main, which was connected with the shield block-valves by three swivel-joint connections. To furnish the pressure, a very compact little pump, designed by Watson & Stillman, of New York, was used without an accumulator, the pressure being very nicely governed by a steam-regulating valve.

On Sept. 22 work was resumed on the New York side, with a small force of men working days only, to excavate in the rock an enlarged chamber about 15 ft. back from the face, in which to erect the shield. This chamber was made circular, about 15 ft. in diameter and 10 ft. long. Back from this, the rock was taken out in a circular form of about 11 ft. diameter, for some 14 ft., or enough for about 10 rings of the cast iron segments which were here erected in the rock, the spaces between being thoroughly grouted with Portland cement. These rings were thus made solid in the rock to withstand the thrust of the shield-jacks upon the lining. The blasting necessary in this work was made as light as possible, but it was not without its effect upon the soft material in the heading, a considerable quantity of the black mud being washed through the bulkhead, while the braces showed signs of a heavy strain from the squeezing of the material. The shield arrived at the works on Nov. 10, and the work of erection was immediately begun. The sections were lowered down the shaft and taken through the air-lock to the shield-chamber. On Nov. 17 the shield was all assembled, and riveting the tail-end sections was commenced. For heating the rivets in the air-chamber a forge was used, with a hood to which was connected at the top a 2-in. pipe with a valve which extended through the air-lock bulkhead. By means of this pipe all the obnoxious gases from the furnace were removed from the air-chamber. After the riveting was finished, the shield was brought to its right position for line and grade, the hydraulic jacks and valves put in place, and the necessary connections made. On Nov. 24 word was received that the work on the New York side was to be pushed with all possible speed, and a force was at once organized of three gangs, working in eight-hour shifts. More rings were built on the ten rings already anchored in the rock, until the tunnel-lining was brought within the tail-end of the shield.

The shield was now advanced until it was necessary to disturb the bulkhead, the remaining bench ahead of the shield being blasted out as the shield progressed. The most difficult part of the work was now reached, for at the point where the shield entered the soft, black mud on top there still remained about 12 ft. of hard rock in the bottom, as the dip of this vein was over 40° toward Long Island. Blasting had therefore to be continued in the bottom pockets of the shield after the top had entered the much-softened material. As soon as the bulkhead was passed it was with great difficulty that the bottom pockets could be kept clear of the black slush from overhead. The material had become so softened along the rock face that it was almost impossible to confine it, and several rushes of inflowing material occurred, until finally an open connection with the river was established, and the tunnel was visited by crabs and mussels, together with boulders, old boots and shoes, brick, and tinware, direct from the river bottom. Notwithstanding these adverse circumstances the work was still progressing, although in 45 lbs. of compressed air, which was now escaping through the heading and causing a very violent ebullition on the river surface. This upward current of air held in check the downward current of water, so that no efforts were made to prevent its escape. On Dec. 13 the shield finally cleared the rock and was now fully entered into the soft, black mud. The main difficulty was now surmounted, the work progressed more rapidly, and the shield soon reached undisturbed material, which was found quite dry and hard. It was still the same black mud, with occasional lumps like charcoal, and numerous nodules like pyrites, which glistened like silver in the black, peat-like mud. Mattocks were used by the men in the working chambers, who would clean out these four compartments to within a foot of the cutting edge. As soon as this was done hydraulic pressure was put upon the jacks, sometimes to the amount of 5,000 lbs. per sq. in., and the shield forced ahead 16 or 18 ins., enough for another ring of plates, the working chambers again being filled with the displaced material. On Dec. 24 the last of the black mud was passed through, and lying next to it, at an angle of 40° towards Long Island, white decomposed feldspar was found, containing fragments of decomposed quartz charged with sulphuretted hydrogen.

An important departure was now made in the method of erecting the cast iron lining rings by breaking joints with the segments. In all the iron-lined tunnels it has been the established custom to erect the rings with continuous horizontal joints. For some reason it was thought inadvisable to attempt breaking joints with the segments. The writer's experience in the Hudson tunnel had shown him the importance of obtaining, in soft, squeezing ground, a perfectly rigid tunnel-ring. In a material exerting hydrostatic pressure the tunnel lining is subjected to a resultant strain, tending to flatten the ring, or decrease its vertical diameter. Any yielding to this strain results both in increasing the deforming pressure and in decreasing the power of the ring to resist the strain. In a lining erected with continuous joints the rigidity of the ring is dependent upon the bolting in the horizontal joints. At the Hudson River tunnel a ring of plates were bolted together lying flat on the ground, the plates all brought to a true circle, and the two 1¼-in. bolts in each joint well tightened. Upon raising this ring with a derrick, so that it stood erect, the ring was flattened 3 ins. by its own weight. At the East River tunnel a similar experiment was made; two rings of plates were bolted together, breaking joints, one ring being revolved two holes. These two rings were then raised upright, but no flattening could be detected. By means of a turnbuckle a measured strain was now brought upon the rings along the vertical diameter. At 16,000 lbs., the vertical diameter was shortened ½ in., the flanges of the plates cracking where the turnbuckle was attached. In these two instances there was, of course, a great difference in the size of the rings, those in the Hudson tunnel being 18 ft. inside diameter, while those in the gas tunnel were only 10 ft. 2 ins. inside diameter.

Aside from the rigidity gained, breaking joints has proved much the better in other ways. With continuout joints, two things are apt to occur: (1) The joint-face where two rings meet may become slightly warped; that is, all points on this face of the ring will no longer lie in the same plane. This may be caused by carelessness in allowing dirt to get into the joints between the rings. When this once occurs the warping increases with every additional ring till true joints can no longer be made. (2) The rings may be erected so as to depart gradually from a true circular form. This latter case is impossible where the joints are broken, and, in the former instance, by breaking joints, the error is divided and distributed around the ring until it disappears.

On Jan. 16, 1894, the end of the soft seam was reached with the shield, and rock was again entered after having passed through 98 ft. of soft ground. This rock resembled slightly the rock on Blackwell's Island. It was in a much shattered condition, with many loose heads and small, soft veins. As this material required support in the heading and a permanent lining, and as, in its present condition, there was no assurance that it might not again pass into soft material—shield tunneling was still continued. Small machine-drills were set up in the four working chambers of the shield upon arms bolted to the vertical platform, and the rock was drilled and blasted just ahead of the shield. The progress of 4 ft. per day was made in this material, of which there was about 65 ft. The rock then became much more solid, with a roof that was self-sustaining, and arrangements were made for removing the shield. On Feb. 18 the work of removing the shield was begun, and two days later everything was ready for the regular rock-tunnel work in the heading, the shield having been taken apart and removed in that time.

At about the time that shield tunneling was being discontinued at New York, it was being installed at Long Island. An entire duplicate plant had been ordered for this side, for, although it had been originally intended to use one shield for both headings, it was later deemed advisable to provide a shield for each heading, so that there might be no delay, should soft ground be met in both headings at the same time. In passing through the soft seam at Ravenswood with the shield, no especial difficulties were met. The material proved to be a mass of soft rock fragments, boulders and cinder-like stones imbedded in soft, green chlorite. About a month was consumed in passing through this seam, removing the shield, and prolonging the cast iron lining well into the rock on both sides of the vein. With both tunnel headings now in rock, remarkably rapid progress was made, and as progress now had become of great importance to the company, a liberal bonus, arranged on a sliding scale, was given the foremen for work done over stated amounts. Up to the time of the headings meeting an average progress of 69 ft. per week was made, while in rock, on both the New York and Long Island sides. The record week of the work, was the one ending June 27, when at Ravenswood 95 ft. was driven, while on the New York side, the heading was advanced 101 ft., making a total for the week of 196 ft. of tunnel driven. Soon after the rock tunneling had been resumed on the New York side, this heading reached Blackwell's Island, and the troubles on this side were over. But at Ravenswood,

*Drawings of this shield were published in our issue of March 1, 1894.—Ed.

with the heading in white limestone, there was every reason to expect further soft seams where the rock should change to the granite gneiss of Blackwell's Island. These expectations were not disappointed, for after passing through 350 ft. of the limestone, and when within 200 ft. of Blackwell's Island, a soft seam was met, and air-pressure had to be once more used in the heading. As this seam was but 14 ft. in width, and presented no especial difficulties, the tunnel was carried through it without using the shield, the cast iron segments being erected under a timber roof. Gneiss was encountered on the other side of this soft vein, which brought with it the assurance that the last of the soft ground had been passed. On May 16 a serious loss and delay was caused by a fire which destroyed the New York works. The fire started in an adjoining picnic ground, containing many light frame structures, which caused so fierce a conflagration that it was impossible to save our works. This caused a delay of three weeks in the time of the tunnel's completion. On July 11, 1894, the remaining 15 ft. of rock between the headings was blasted away, thus opening the pioneer tunnel under the East River, two years from the time when ground was first broken. Some weeks were spent in clearing up and shutting out the water in the wet places. A 3-ft. gas main was now laid through to New York, and in Oct. 15 gas was delivered into the city, accomplishing the purpose of the tunnel.

CHICAGO MAIN DRAINAGE CHANNEL.

VIII.

Section I. Willow Springs Division.

This section has been in the hands of two contractors since work was begun. On July 13, 1892, the first contract was awarded to Alfred Harley, of Chicago, at 27 cts. per cu. yd. for glacial drift, 83½ cts. per cu. yd. for solid rock, and $1.37½ per cu. yd. for retaining walls. The river diversion work was to be done first, according to the contract, but up to Sept. 1, 1893, very little had been done. Meanwhile Sections 2 and 4 had been taken from the contractors, and nothing was being done on the river diversion work on those sections. As it was important that this work should be completed immediately, the Sanitary District decided to do it by day labor, especially as at that time an army of unemployed were clamoring for work in Chicago, to whom the opportunity for employment would be a godsend. An agreement was entered into between the Sanitary District and Alfred Harley for Section 1, and McArthur Bros. for Sections 2 and 4, whereby they were to act as agents for the district, supplying all necessary tools and equipment and superintending the work for a commission of 15% on the cost of the work. Unemployed men from Chicago were thus given work in large numbers, but it proved very expensive to the District, costing about 86½ cts. per cu. yd. for glacial drift excavation. In a report on the work Chief Engineer Isham Randolph said:

> This work may be regarded as an object lesson, clearly demonstrating from an economic standpoint the unwisdom of entering into any arrangement for carrying on the construction work of the District by the direct employment of labor.

While this work was going on, the contractor for Section 1 had done little or nothing on his contract proper, and as at the beginning of 1894 there seemed little prospect that he would do better, the Board of Trustees declared the contract forfeited Feb. 10, 1894. Some changes were made in the length of the section and other features of the work, and the work was readvertised, the bids being opened April 18, 1894. The lowest bidders were the Johnson & Bradley Co., who bid 39½ cts. per cu. yd. for glacial drift and 83 cts. per cu. yd. for solid rock. The total amount of their bid was $1,141,107. On May 23 the Board of Trustees awarded the contract to Griffiths & McDermott, the next lowest bidders, it being considered that the financial ability and experience of the Johnson & Bradley Co. were not such as would warrant the contract being let to them. It should be stated in this connection that this action was opposed by two members of the five composing the Committee of Engineering and Finance, who submitted a minority report recommending that the contract be let to the Johnson & Bradley Co. Indeed an injunction was secured by this company forbidding the Board of Trustees to let the contract to Griffiths & McDermott, but this was dissolved and the contract with the last named firm was signed June 6, 1894.

The total amounts of material to be excavated on Section 1, according to the latest estimates, are 1,348,406 cu. yds. of glacial drift and 536,024 cu. yds. of solid rock; 174,655 cu. yds. of the glacial drift being river diversion work. The prices at which Griffith & McDermott are doing the work are 42.9 cts. per cu. yd. for glacial drift, 80 cts. per cu. yd. for solid rock and $2.90 per cu. yd. for retaining wall. As stated in the description of Section A, a large amount of hard material was taken from Section 1 to fill in the trestle levee across the marsh between the river diversion and main channels on Section A.

Fig. 31 is a plan of Section 1 made early in 1895, which shows the arrangement of the tracks and inclines for handling the glacial drift. Owing to the irregularity of the ground adjacent to the channel it was found impracticable to use inclines until a level berm had been made for them by locomotives and cars. The first work of the contractors was therefore to take out the glacial drift with steam shovels and haul it to the berms and also to the trestle

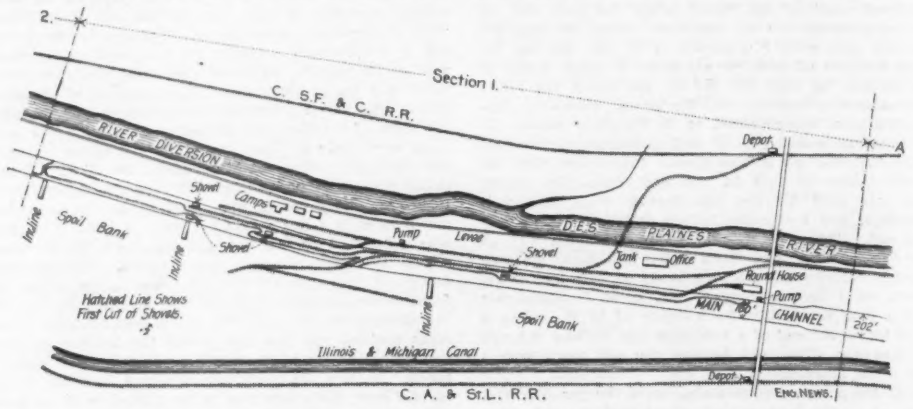


FIG. 31. GENERAL PLAN SHOWING METHOD OF EXCAVATION ON SECTION 1, CHICAGO MAIN DRAINAGE CHANNEL: Griffith & McDermott, Chicago, Contractors.

levee. Five locomotives and about 80 cars of about 6 cu. yds. capacity were used in this work. The plan, Fig. 31, shows plainly the arrangement of the tracks and the methods of operating the shovels. It will also be noticed from this plan that the cross-section of the channel changes from 202 ft. to 160 ft. wide on the bottom, or, in other words, that the earth channel stops and the rock channel begins on this section. The first retaining wall work also occurs on this section.

The glacial drift overlying the rock is very hard to excavate. It consists of a tough gravelly soil interspersed with a profusion of boulders varying from 1 ft. to 10 ft. in diameter. Hardly any of it can be excavated by steam shovels without blasting. Four Bucyrus special contractors' shovels are used. The following records taken from the report of the Superintendent of Construction show the output of these shovels for several months.

	—Sept., '94.—		—Oct., '94.—		—Dec., '94.—	
No. of shovel.	Shifts.	Ave. cu. yds. per shift.	Shifts.	Ave. cu. yds. per shift.	Shifts.	Ave. cu. yds. per shift.
172	12	433	3	567	..	..
177	28	630	12	350	28	468
179	29	413	35	514	29	469
181	29	336	50	444	36	492

In November, 1894, the four shovels worked 97 ten-hour shifts and excavated an average of 500 cu. yds. per shift each. In January, 1895, the four shovels worked 103 shifts and excavated 215 cu. yds. per ten-hour shift each. The comparatively low average in January was due to the very cold weather and frozen ground.

As soon as a level berm had been graded by the locomotive and cars, inclines much similar to those used on Sections M and L were constructed. These are all trussed structures, two being built of wood and iron and two of iron alone, and are mounted on trucks so that they can be moved along the berm of the canal. The top chord of the incline carries the tracks and has an inclination of about 30° from the horizontal. Each incline has an inclined trestle approach, which consist of short king post spans supported on trestle bents, which in turn rest on greased timbers so that they may be slid along as the work proceeds. The method of operation of these incline conveyors is exactly like that on Sections M and L. An open end car is hauled by a winding engine to the top of the incline, where it runs onto a tipple, which revolves and allows the load to slide out.

The two wooden inclines are used in handling glacial drift and the two iron inclines for handling rock. Fig. 32 shows the arrangement of the inclines and track system for the rock work, and also plans of the two derricks carrying the air-hoists used in loading large rocks. One incline with its system of tracks works west and the other east, the two completing the excavation as they proceed. Referring to the illustration, it will be seen that the cars are loaded at the face, hauled by mules along the tracks a, b, c, etc., to the turntables, where they are turned onto the incline tracks, hauled to the top and automatically dumped by the tipple arrangement. A reversal of this process brings the empty cars back to the face. It may be stated at this point that this is the only instance on the Drainage Channel where the traveling incline and tipple are used for handling rock.

The cars used are made of steel, and are open at the forward end to allow the load to slide out as the tipple revolves. As will be seen from the plan, Fig. 32, there are nine tracks, and one car is used for each track. The loading is done by hand for all material that can be handled with a shovel or by a single man. For handling the larger stones a system of air-hoists is used. Fig. 33 shows the location of these hoists, the boiler, air-compressor, etc. The booms swing in horizontal circles and the hoist may be moved back and forward along the boom, being suspended from a trolley. In this manner any point on the working face can be easily covered. There are four hoists in the plant, two to each working face, and each has a cylinder 8 ft. long and 12 ins. in diameter. They are supplied with air from the compressors on the framework as shown. These compressors, one of which is an 18×24-in. piston inlet Ingersoll-Sergeant and the other a Rand, also supply the air for the rock drills.

The manner of working the rock face needs but little explanation. A series of holes are drilled parallel to the face and transversely across the channel and the rock blasted out. A force of between 30 and 35 men is then distributed along the face and the cars loaded by hand and by the air-hoists. When the work was visited by a representative of this journal, six men were being used to operate the hoists on each face, this force changing from one air-hoist to the other. The right-hand hoist would be worked until all the large stones convenient to access were taken out, when the hand laborers would be set at work cleaning away the chips and small stones until more of the larger stones were laid bare. Meanwhile the operator would go to the left hand hoist and clean out the large rocks there. By this method the laborers were kept busy on small stones without delays to move the heavy rocks. Two sets of chains and grab-hooks were used with each hoist, two men taking care of each set. This allowed the hoist to travel from the face to the car with the minimum delay for fastening and unfastening the chains. While the hoist was traveling to

the car; one pair of chainmen were making fast to a rock on the face, and while the hoist, having deposited its load in the car, was returning to the face, the second set of chainmen were unfastening their chain from the deposited load and getting it back to the face to attach another stone. One man operated the hoist and one man took care of the rope by which the boom was swung and the trolley moved along the boom. Generally one or two men remained on the face to loosen the stones and assist in fastening the chains when needed. Thus far not enough material has been handled with this system to enable any very useful figures of its capacity to be given. Such figures will be given in a future article.

The section is very well equipped with shops,

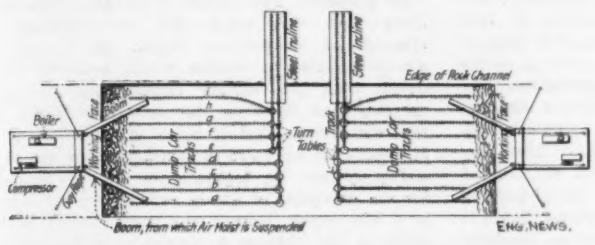


FIG. 32. PLAN SHOWING ARRANGEMENT OF AIR HOISTS, TRACKS AND INCLINES FOR EXCAVATING ROCK.

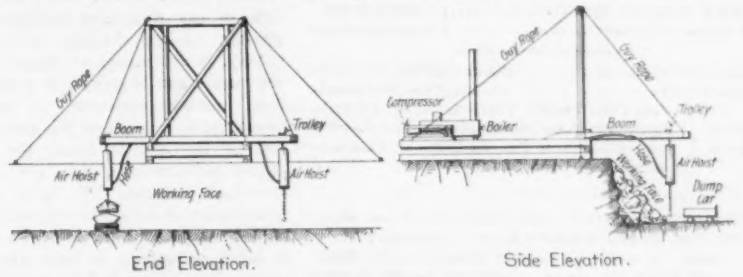


FIG. 33. SKETCH SHOWING CONSTRUCTION OF AIR HOIST APPARATUS FOR LOADING LARGE ROCKS.

pumping stations, water tanks, and all similar plants necessary for the convenient and effective prosecution of work. Each of the pumping stations is provided with a 100-HP. boiler, an 80-HP. engine and a 12-in. centrifugal pump. In addition to this stationary pumping plant each shovel has a steam jet pump, and a 6-in. centrifugal pump, with an engine and boiler to drive it, has been mounted on a flat car which is run from one point to another as occasion demands. The blacksmith and machine shop is provided with a drill press, steam hammer, engine lathe, and various smaller tools. To provide water for the various purposes, a water main, supplied from the Desplaines River by two $4 \times 6 \times 4$-in. Snow pumps, runs the entire length of the section.

We are indebted to the Griffith & McDermott Construction Co., the contractors on this section, for the plan from which Fig. 31 has been prepared and for much information regarding the method of conducting the work, and to Mr. Chas. W. Melcher, of the Ingersoll-Sergeant Drill Co., for the drawing from which Fig. 33 has been prepared.

STEEL FRAMEWORK FOR MINNEAPOLIS, MINN., COURT HOUSE ROOF.

(With Inset.)

The designing of the steel framework of roofs, and especially of irregular roofs much broken with gables, towers, chimneys, etc., involves problems in economical structure and manufacture which are, in their way, fully as important as any encountered in steel building design. As a rule, these problems are not of eminent difficulty, and probably for this reason little mention is made of them in the current literature relating to structural design. They contain factors, however, which by proper or improper treatment make all the difference between good and bad design, or perhaps in many cases between success and failure to secure a contract, and for these reasons deserve to be looked after carefully.

In our issue of Dec. 20, 1894, we published a pertinent article on the design of the various hip and valley angle connections which occur in irregular roof work, and we supplement that article this week with some hints of a more general character regarding the design of the trusses, purlins, jack rafters, etc., in similar work. The particular work illustrated is a design for one side of the Minneapolis Court House roof, which was submitted by the Gillette-Herzog Mfg. Co., of Minneapolis, Minn., and accepted by the Board of Commissioners.

Fig. 1 is a skeleton plan of the roof, with the T-bars to which the roof covering is attached omitted for the most part to avoid confusion. As will be seen the plan is decidedly unsymmetrical. Not only do the main features of the different sections of the roof differ, but the various dormers, towers, etc., are quite irregular in style and dimensions. With the architect's drawings showing the location of the walls and columns, and the location, size and style of the different roof features, the problem was to design a framework adequate to the demands of the specifications in strength, workmanship and adaptability to its purpose, and one which could be constructed at the smallest cost.

The first step was to secure uniformity to as great an extent as possible, not only between different trusses but between individual members of dissimilar trusses, and also by adopting a truss type applicable to all dimensions of trusses. In other words, if two or more trusses could be made exactly alike, shop work and drawing were saved; and if trusses as a whole could not be made alike, even then a certain amount of shop work and drawing was saved by making the dimensions of single members common to as many trusses as possible. Further, by keeping to a common type of truss, a standard style of connections and a standard system of erection could be used.

A modification of the Fink type of truss was adopted, as is shown in Figs. 2 to 9, inclusive, and it was also planned to make use of the columns as intermediate supports wherever possible. The trusses were, therefore, designed to rest on the walls at their ends, with their strut and post members supported on the intermediate columns whenever possible. The manner in which the various requisites just noted were attained is shown by Figs. 2 to 13, inclusive. For example, in trusses 14, 15, 16 and 17 there is a ceiling load to be carried at different elevations the whole length of the truss, with only one intermediate column support, while the trusses, on either side of these four, have two column supports and only a partial ceiling load. It will be observed, however, that the three groups of members into which each of these trusses is divided are identically the same, so far as center lengths of the members in corresponding groups are concerned, and the same thing is true of the three trusses 10, 20 and 21, which rest at one end in the smokestack. Thus these 12 trusses, which are in reality very different as to their duties and means of support, are, as far as center lengths are concerned, covered by a single series of calculations. By following through the other trusses, the same governing principle of uniformity will be observed.

Turning to the smaller members of the roof, it will be seen that the main trusses carry at each intermediate truss point along the rafters lines of 12-in. and 15-in. channel purlins. These purlins in turn carry 8-in. channel jack rafters, running parallel with the trusses, and spaced so as to divide the space between any two trusses into three equal parts. The top flanges of the jack rafters are in the same plane as the top surface of the main truss rafters, and carry $2\frac{1}{2} \times 2\frac{1}{2} \times 5\frac{1}{16}$-in. T-bars spaced 18 ins. c. to c. It will be noticed that all the strut members of the main trusses to which the purlins are attached are perpendicular to the rafters which they support, so as to obviate the use of shims between the top flanges of the purlins and the bottom flanges of the jack rafters. Channels and I-beams are used wherever possible, because of the low price of these shapes at the present time.

In calculating the stresses in the different members of the roof the weight of the roof material was taken as 12 lbs. per sq. ft. and the dead load as 60 lbs. per sq. ft., or altogether a load of 72 lbs. per sq. ft. of roof surface. The wind pressure was assumed as 36 lbs. per sq. ft. of vertical projection of roof. With these loads and the simple type of truss used, all calculations were easily and rapidly made by graphics. The extent to which uniformity of the trusses reduced the work of calculation will be seen at once by preparing for truss 14, Fig. 6, a right and left wind diagram and a load diagram for each of the three divisions b c d, b d f e, and a e f; and noticing with what slight modification these diagrams will answer for the other trusses, Figs. 2 to 8, inclusive.

In connection with these general features there are one or two matters of detail to which attention may be called. The first of these is the method of supporting the point of juncture of the main ridges with the main towers, Fig. 10. In the two small towers, Figs. 12 and 13, the members for tying the hip trusses are arranged to run in the same plane as the tower roof, and do not extend across the tower to obstruct the space for stairways. The whole roof has been arranged to prevent any thrust coming onto the masonry. In ordinary steel skeleton construction for the body of the building of course this thrust can be provided for by properly bracing the outside columns below the roof, or in other ways; but in the roof under consideration this was not possible, as no outside columns were available. All main trusses were therefore provided with friction plates in the walls, and the jack-rafters were tied to the main trusses by angles so that no thrust came upon the walls from them. (Fig. 1.) The trusses for the towers were provided with nests of friction rollers at one end. It may be noted also that the lateral rods tying together alternate pairs of trusses pass through the webs of the channel jack rafters, oblong holes being punched in them for that purpose.

The drawings show various other details of interest which need not be mentioned here. The principal feature emphasized by the illustrations, however, is the governing principle of uniformity upon which the framework was designed. We are indebted to Mr. Frank J. Llewellyn, Vice-President and Chief Engineer of the Gillette-Herzog Mfg. Co., for the matter from which our illustrations have been prepared.

The specifications for the 50 miles of road improvement in Morris county, N. J., noted in our issue of June 6, provide for three classes of work—namely, telford paving and 6-in. and 4-in. macadam paving. The telford paving is to have a foundation course of large stones, laid on their broadest sides, and covered with 2½ ins. of 2½-in. broken stone, 1½ ins. of 1½-in. stone, and a finishing course of screenings. The 6-in. macadam will be composed of a 4-in. bottom course of 2½-in. stone, a second course of 2 ins. of 1½-in. stone, with such binding material as the engineer may approve, and a ¾-in. top course of clean screenings, watered and rolled until a wave of water flows before the roller. The 4-in. macadam paving will have a bottom course of 2½ ins. of 2½-in. stone, a second course of 1½ ins. of 1½-in. stone, and a ¾-in. top course of screenings. The roller is to weigh not less than 5 tons in a width of 5 ft. The bottom course may be of any hard and durable stone, the other courses and screenings must be of hard and tough stone. Mr. Wm. B. King, of Landing, N. J., is the County Engineer, and Mr. J. C. White, of Morristown, N. J., is Clerk of the Board of Freeholders. Contracts for the work were to be opened on June 20, but the opening was postponed and several additional roads were included and the opening is now announced for July 16.

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We advise the secretary of every engineering society which boasts an engineering library to sit down as soon as this copy of Engineering News reaches him and forward to the Secretary of the New York Aqueduct Commission the formal application of his society for a copy of the report just issued and reviewed on another page of this issue. This handsome and costly volume contains matter which makes it of great value as a work of reference for engineers, and it is of so little interest to those outside the profession that it is to be hoped that the engineering libraries of the country, at least, may be supplied from the small edition which has been printed.

The tunnel of the East River Gas Co., from Ravenswood, Long Island, to East 71st St., New York city, under the East River and Blackwell's Island, was described and illustrated in our issue of March 1, 1894; but some interesting features in connection with its construction have been recently described in a paper before the Boston Society of Civil Engineers, by Mr. Walton I. Aims, Jr., who was Superintendent of the work, and we reprint Mr. Aims' paper elsewhere in this issue.

The experience in this tunnel furnishes about the only precedent in the annals of engineering of the use of shields in a tunnel passing from rock to soft material and vice versa. How to proceed when the top of the cutting edge is in soft mud, and blasting has to be done in front of the lower part of the circumference, is a problem which may well puzzle an engineer, and its successful solution at the East River tunnel speaks much for the ability of those in charge of the work. The use of broken joints in the cast iron lining is an innovation which should have the attention of every engineer who has to use such linings in tunnel work. Mr. Aims points out that the ordinary cast iron lining depends solely on the strength of the longitudinal joints to resist forces tending to deform the ring; and he, therefore, substituted broken joints. While this doubtless increases the strength of the lining against forces tending to flatten it, the fact should not be overlooked that in tunnels of large size any lining yet used, of either iron or masonry, can interpose but a small resistance to forces tending to flatten it. A ring of tunnel lining is intended to act as a continuous arch and unequal pressures cause an effect like weakening the abutments of an ordinary arch. A cast iron lining has not sufficient thickness to support any considerable bending strain.

Other points of interest in connection with this tunnel were the assembling the shield inside the air lock, the parts being taken through the lock; and the use of the shield in driving the tunnel through 65 ft. of rock, compressed air drills, mounted on the shield, being used. The air pressure used on the work reached 52 lbs. at times, a higher pressure than has ever before been used on work carried out by the plenum-pneumatic process.

The address of Dr. Louis B. Duncan, the President of the American Institute of Electrical Engineers, at the Niagara Falls meeting of that society, is abstracted at length on another page of this issue, and is especially notable, as it gives the most sensible statement of the possibilities and probabilities concerning the much-talked-of substitution of the electric motor for the locomotive on steam railways that has yet appeared from any electrical engineer. We have grown accustomed to a display of fireworks whenever an electrician discusses the question of electricity vs. steam; hence it is most refreshing to hear Dr. Duncan candidly stating that heavy freight traffic is now handled on steam railways at so small a cost that it is quite useless to hope to make a saving by the substitution of the electric motor. For through passenger traffic, too, Dr. Duncan does not consider the prospects of the electric motor by any means flattering; a fact which will doubtless surprise those who have been in the habit of believing the representations made by promoters of hundred-mile-an-hour air-line electric railways.

As to the actual field in which the electric motor can compete with the locomotive, Dr. Duncan's idea, summed up in fewest words, is that (1) it might possibly pay to operate passenger trains on a four-track road by electricity, running the local passenger trains on the freight tracks at freight speeds; and (2) that short branch lines, with heavy passenger traffic and little freight traffic, can be profitably changed over to electricity.

We wonder if Dr. Duncan realizes what a very small mileage of four-track road there is in the United States. It amounts, all told, to 670 miles, according to the Interstate Commerce Commission's figures, and the New York Central line and the Pennsylvania main line constitute the bulk of this. Dr. Duncan himself says that these two roads haul so many foreign cars that it is doubtful whether the express service could be well handled by electricity, and with these two lines excluded from consideration, the four-track road proposition has little to stand upon.

Perhaps we may reach a clearer idea of where the debatable ground between steam and electricity lies by considering first the simpler question, What kind of a train will it pay to haul by electricity? Dr. Duncan admits that the modern freight train is now handled at less cost than it could be handled by an electric motor, and we believe the same rule applies to the hauling of a long train of sleeping or parlor cars, or even of day coaches. In other words, when you can give a locomotive a full train to haul, it can do the work at less cost than an electric motor. But now let us go to the other extreme, and take the average local passenger train of two or three cars, and carrying anywhere from 5 to 50 passengers. A single electric car would do the work of such a train at probably one-third the expense for train crew, and, perhaps, as great a reduction in the cost of motive power. The average number of passengers carried in a passenger train in the United States is only 42. So far as the expense of conducting transportation is concerned, therefore, the electric motor could compete with the locomotive for passenger traffic over a very wide field. On the other hand, the branch lines, which have this light passenger traffic, have, as a rule, too little traffic to pay the interest on the cost of electric equipment. The problem for the engineer to solve in each particular case, therefore, is: Will the reduced operating expenses due to the equipment of this branch with electricity be sufficient to pay a profitable rate of interest on the capital required for electric equipment?

Two cases have recently been reported of interference with electric signals on a steam railway by the ground current from an electric trolley line. One case was at Ashland, Ky., and the other was at Chicago, Ill., and was reported in a paper by Mr. G. W. Thayer, at the annual meeting of the Railroad Telegraph Superintendents' Association, held at Montreal, last month. Particulars are wanting with reference to the first case; but in the second it is stated that a Hall signal, operated on a track circuit on the Chicago & Northwestern Ry., would go to danger on the approach of the trolley car and remain there until the car had passed and gone on some distance. The author of the paper thought it likely that this really did not introduce an element of danger to trains, as a pair of wheels entering a section would probably short-circuit both the battery current and the stray current, thus throwing the signal to danger, but was not certain that it would do this invariably. If electric railways are to continue to use the single trolley system, an argument is thereby furnished for the operation of steam railway electric signals by a wire circuit, instead of a track circuit. It was noted on the Chicago & Northwestern that signals operated on a wire circuit were not affected by the trolley currents.

We reprint in another column one of the papers presented at the International Railway Congress, now in session in London, which carries probably as much information of value to American railway officers as any paper presented at the Congress.

The paper treats of the methods employed in handling freight in the yards and stations of English railways; and the efficiency which has been obtained in handling an enormous volume of merchandise freight, with room for terminals greatly restricted, is highly creditable to English railway managers. In this country the very long haul of a large proportion of our freight, coupled with the cheapness of land for terminal purposes in the early years of railway operation, has caused chief attention to be paid to the problem of reducing the cost of hauling freight on the road. It is only within recent years, that the problem of handling a great volume of freight at terminals in the most economical manner has become pressing in this country; and we have as yet hardly essayed the task of handling such traffic in the smallest possible space and releasing a part of the large area of expensive land now occupied for freight handling purposes in every important city. English practice in the handling of freight is notable for its extensive use of power cranes, and for the promptness with which merchandise traffic is handled in and out of the great freight warehouses. The superiority of the American freight car for handling long-distance traffic, especially where bulk freight is concerned, is generally admitted, but there is much reason to believe that the small "goods trucks" of the English railway system are well suited to handling the high-class merchandise, short-haul freight, which furnishes a large proportion of the traffic on English railways.

An engineer is wanted for the new East River Bridge, which is to connect New York with Brooklyn, and the Commissioners in charge of the work state that a multitude of applications for the position have been received. It is far from strange that this should be the case, for the structure will be one of the great bridges of the world, and its engineer, if he does his duty, will not only earn a handsome salary for several years, but will make for himself a wide and valuable reputation. It is to be hoped, however, that the numerous applications for the position may not cause the Commission to cheapen the engineer's services, or to allow the price asked by an engineer for his services to influence them in the selection. Apparently this will not be the case, for one of the Commissioners, in a newspaper interview recently, said that the Commission recognized the weight of responsibility resting on the engineer of this structure, and desired to appoint the best engineer available, no matter how large a sum his services might cost.

This is in refreshing contrast to the sentiment ex-

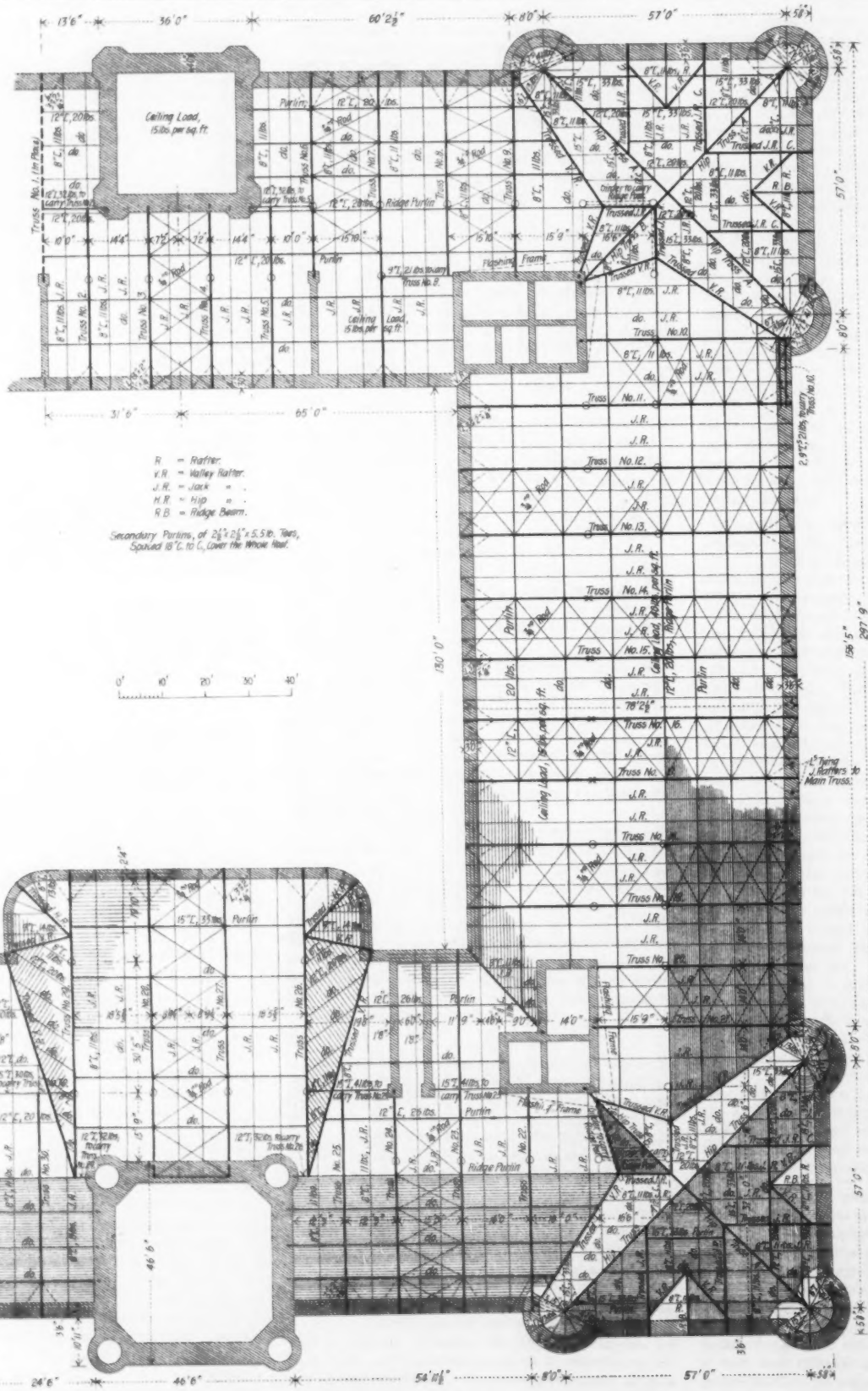


FIG. 1. HALF PLAN OF ROOF SHOWING LOCATION OF COLUMNS, WALLS, ETC., AND ARRANGEMENT OF STEEL WORK.

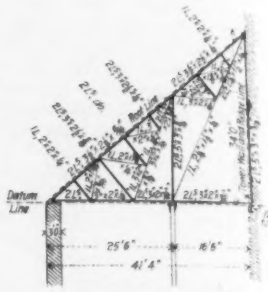


FIG. 2.

Trusses No. 2, 3, 4 and 5.
(Nos. 2 and 5 rest on I-Beam, 3 and 4 on Tower Wall.)

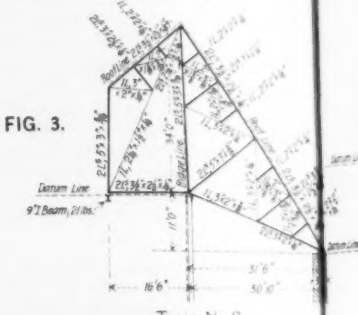


FIG. 3.

Truss No. 8.

FIG. 4.

Truss No. 7. (Trusses Nos. 6 and 9 Same but Cut off as Shown.)

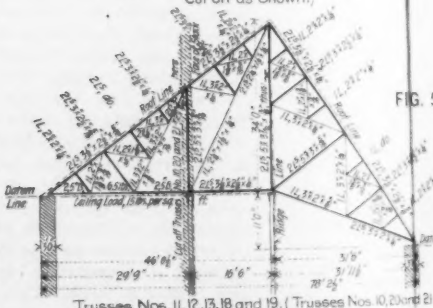
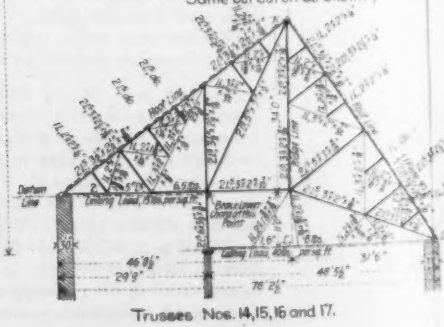


FIG. 5.

Trusses Nos. 11, 12, 13, 18 and 19. (Trusses Nos. 10, 20 and 21 Same but Cut off as Shown.)



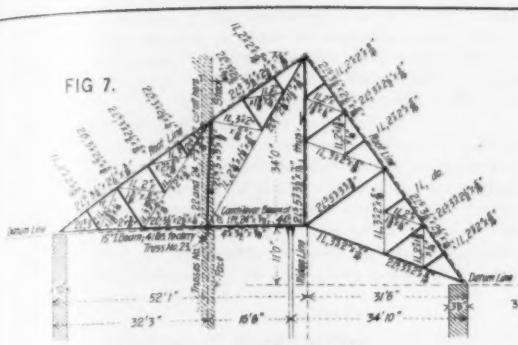
Trusses Nos. 14, 15, 16 and 17.

FIG. 6.

STEEL FRAMEWORK FOR MINNEAP

Frank J. Llewellyn, Chief Engineer.

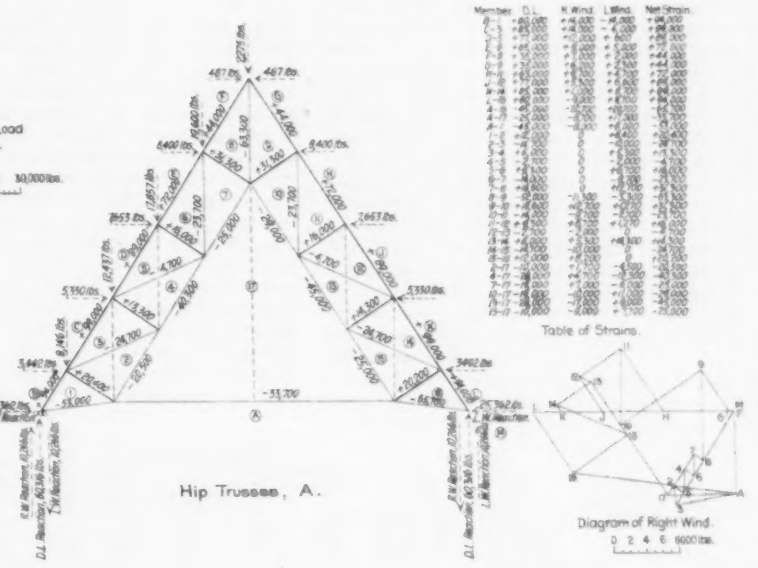
FIG. 7.



Truss No. 23.
(Trusses Nos. 22 and 24 Same but Cut off as Shown.)

Half Dead Load Diagram.

Table of Strains.



Hip Trusses, A.

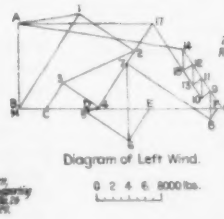
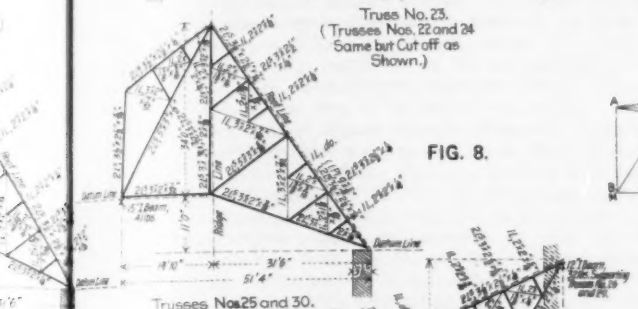


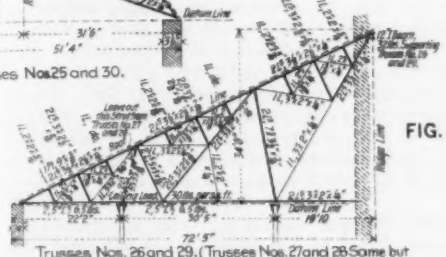
Diagram of Left Wind.

Diagram of Right Wind.

FIG. 8.

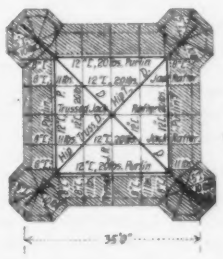


Trusses Nos. 25 and 30.

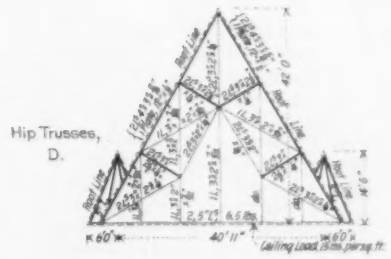


Trusses Nos. 26 and 29. (Trusses Nos. 27 and 28 Same but with Marked Strut Omitted.)

FIG. 9.

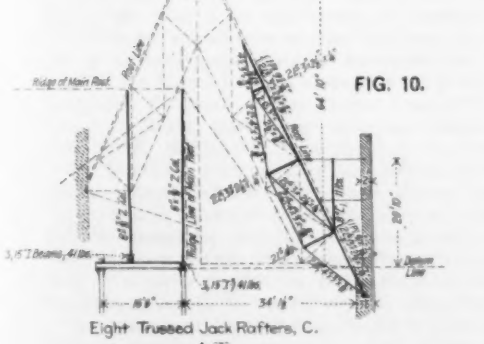


Plan of Roof.



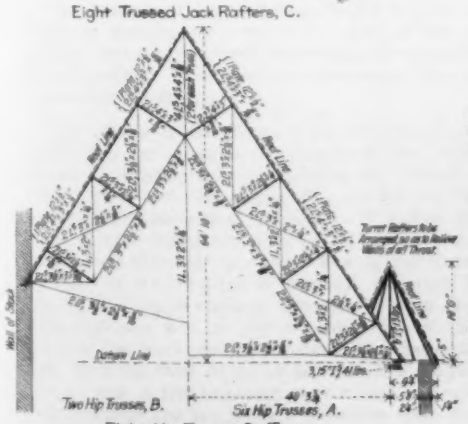
Hip Trusses, D.

FIG. 12. FRAMEWORK FOR SMALL TOWER.



Eight Trussed Jack Rafters, C.

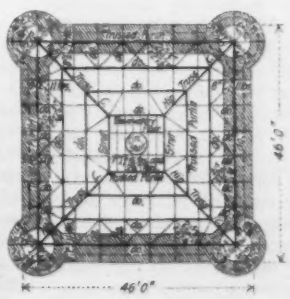
FIG. 10.



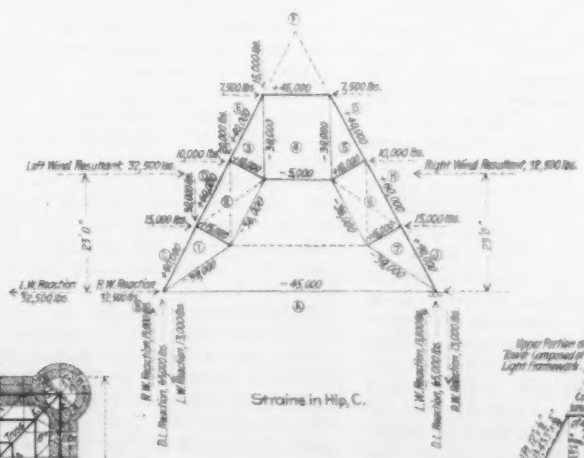
Two Hip Trusses, B. Six Hip Trusses, A.

Eight Hip Trusses for Towers.

FIG. 11.



Plan of Roof.



Strains in Hip, C.

Hip Trusses, C.

FIG. 13. FRAMEWORK FOR MAIN TOWER.

NNEAPOLIS, MINN., COURT HOUSE ROOF.

Gillette-Herzog Mfg. Co., Minneapolis, Minn., Designers.

CHAS. HART & SONS, LITH., 38 VESEY ST., N. Y.

pressed in a letter just received by us from a country town in Florida, in which the writer, who is the Chairman of the Board of Water-Works Trustees, asks for the address of concerns which draw up plans and specifications for such water-works free of charge. "We have very little money to spend," says he, "and do not feel that we can afford to pay anything for plans and specifications."

The fact that a competent engineer can make a little money go much further than it would go without his advice and aid is one which the general public is slow to comprehend. The average man congratulates himself on the dollars he saves by dispensing with an engineer's services, and knows nothing of the dollars lost in exorbitant prices paid or work poorly executed.

The state of Massachusetts is to be congratulated on the prospect that one member of the Board charged with the duty of creating her new metropolitan water supply is to be an engineer, and further on the probability that Mr. John R. Freeman, M. Am. Soc. C. E., will fill the position. The nomination of Messrs. Sprague, Evans and Whipple by the Governor was reported in our issue of June 27; and on July 5 the Executive Council confirmed the nominations of the first two gentlemen; but rejected Mr. Whipple's nomination, on the ground, we understand, that one member of the Board should have been an engineer. The Governor, thereupon, nominated Mr. Freeman for the position, and there is probably little doubt that he will be confirmed. The new metropolitan water supply is one of the greatest public works that has ever been undertaken in Massachusetts, and it will be fortunate, indeed, if so able and experienced an engineer as Mr. Freeman becomes a member of the Board which is to have it in charge.

No state in the Union has done so much good work in the carrying out of public works through commissions as Massachusetts, and its marked success has been due, in no small degree, to the fact that in making up such commissions it has been the usual rule to select one man with expert knowledge. This latest appointment, if confirmed, will make six engineers of national reputation serving on as many commissions in Massachusetts, as follows: Mr. Hiram F. Mills, State Board of Health; Prof. Geo. F. Swain, Boston Transit Commission; Albert F. Noyes, Metropolitan Sewerage Commission; W. E. McClintock, State Highway Commission; Desmond Fitzgerald, State Topographical Survey Commission; John R. Freeman, Metropolitan Water Board. Some of these men have held the positions named for years, all with eminent success, while the past records of the newer appointees are such as to leave no doubt as to the advisability of placing engineers in the highest administrative offices.

The example of Massachusetts ought to have its effect in teaching other states the value of the executive ability and expert knowledge of an experienced engineer in making up commissions for the conduct of public works.

The officers of the North River Bridge Co. officially deny any intention of relinquishing the charter rights acquired by them for bridging the Hudson at New York, notwithstanding the rumors to that effect which have been circulated. It is true that their charter would expire on July 11, unless something were done by that time showing the sincere purpose of the company to construct the work for which they have obtained powers. It is to show this intention and to prevent their charter from lapsing that work was quietly commenced some time ago upon the New Jersey anchorage. The company claims that it has expended more money in acquiring property and has made a beginning upon more substantial work than was the case with the New York and Brooklyn Bridge enterprise at the same period in its existence. The officers of the North River Bridge Co. fully recognize the fact that it takes time and hard work to raise the $36,000,000 required; $21,000,000 for the bridge proper and $15,000,000 for property and accessories. This is an enormous sum of money, and the financiering of the bridge far exceeds in difficulty the engineering problems presented, unprecedented as these last are. According to the financial prospectus now in the hands of the bankers of this and foreign countries, it is proposed to issue 10 per cent. first mortgage bonds, with 5 per cent. to be paid and 5 per cent. allowed to accrue, making a $1,000 bond worth $2,000 in 20 years. These bonds would mature in 150 years, but provision has been made whereby all bonds may be redeemed many years before this time. A prominent New York firm is said to be negotiating for the marketing of these bonds, mainly abroad, with every prospect of success. The important point in this financial undertaking is to satisfy investors that good interest can be earned on the capital required; and the officers of the company claim that, as the result of careful investigation and recent developments in electric traction, they are now convinced that the local traffic alone will pay interest upon the cost of the bridge itself, and that the through passenger and freight traffic of steam railways will follow later. The "down town" location of this bridge, on a line with 23d St. and about three miles below the proposed crossing of the New York and New Jersey bridge, is regarded as being peculiarly favorable to the development of local traffic across the bridge.

CONCERNING THE COST OF SHIP-CANALS.

The North Sea and Baltic Ship-canal has the remarkable record, among enterprises of its class, of being built within its original estimates of cost and of having the smallest cost per mile of any ship-canal thus far built. There are only four important ship-canals in existence, if we do not include under this head improved commercial entrances to old ports, or dredged channels of comparatively short lengths creating new ports for ships of deep draft. These four are the Suez, Corinth, Baltic and Manchester canals. And between these canals it is difficult to make any fair comparison of cost per mile, owing to the very dissimilar natural conditions in each case, and the very different financial and political problems involved in their construction. But it is interesting, nevertheless, to make this comparison, and to gather from the work recently done in connecting the Baltic and the North Sea some points bearing upon projects of a like nature now being promoted elsewhere.

Compared by dimensions and cost, the four great canals referred to approximately stand as follows, up to the dates of their several openings to traffic:

Name.	Total l'gth, miles.	Time of ex-ecut'n, years.	—Normal dimensions.— Least bot. width, ft.	Least surf. width, ft.	Least depth, ft.	Deepest cutting, ft.	Total cube ex-tracted, cu. yds.	Total cost at open'g.	Cost per mile at open'g.	Materials.
Suez	90	10	72	190	26	85	90,000,000	$93,000,.00	$1,033,000	Sand.
Corinth	3.7	12	72	75	26¼	250	10,000,000	15,000,000	4,057,000	Rock, earth.
Baltic	61½	9	72	197	29½	100	100,000,000	37,440,000	614,000	Sand, mud.
Manchester...	35½	7	120	172	26	66	53,500,000	77,000,000	2,170,000	Earth, rock.

Bill No. 457, lately passed by the Legislature of Illinois, and vetoed by the Governor, furnishes an example of the facility with which the promoters of quixotic schemes often secure the sanction of legislative bodies. This bill proposed on its face to commit the state of Illinois to the construction of a waterway, 14 ft. in depth, from Lake Michigan, via the Desplaines and Illinois rivers, to the Mississippi River and on to the Gulf of Mexico. In connection with this project the Chicago Drainage Channel was to be duly considered in relation to its uses "as a harbor for shipping, and also for ocean vessels, in accordance with such plans for connecting the lakes with the ocean as may be projected by the Commissioners of the United States." Reading between the lines, however, the real purpose of this bill seems to have been to secure the appointment of a "Commissioner of Waterways," who was to receive a salary of $500 per month for two years, and whose duty it would have been to expend the balance of an appropriation of $25,000 as he saw fit. The only merit in the whole bill lay in the proposition to examine and survey the Illinois River, with a view to ascertain to what extent it could be improved for navigation; but this has already been done in part, and could be better done as a whole, by the United States Engineers than by any State Commission. The Governor vetoed the bill, on the grounds of utter impracticability and as being unconstitutional; the scheme being valueless without the co-operation of the national government and that of other states. The promoters of the bill, in attempting to provide a snug berth for some "political engineer," specified that the proposed canal should have a capacity sufficient to pass vessels of not less than 14 ft. draft, with provisions for increasing the depth of channel, and also that it must accommodate the largest Mississippi steamboats and a tow of barges carrying not less than 10,000 net tons of freight. Such a trunk waterway would, perhaps, be very useful when in full operation; but the Governor very sensibly concluded that the dimensions of the scheme were somewhat too formidable for the state of Illinois to undertake it alone, or even to take any preliminary steps in that direction.

In announcing Mr. Kent's position on the staff of this journal last week, we stated that he is now a trustee of Stevens Institute. We learn, however, that his term of office extended from 1890 to 1893. Mr. Kent's many friends will be pleased to learn that he returned from his European tour last month much improved in health, which had been somewhat impaired by his labors upon his book; and he hopes when he takes up his editorial duties a week or two hence, to be fully restored to health.

As it is impossible in the case of all these canals to separate incidental expenses from the actual cost of construction, the above seems the only fair basis of comparison in cost per mile. But in estimating upon other work of this character, these figures must be taken with caution; and, in fact, they have little value as a guide unless in each case all prevailing or controlling elements are duly considered. For example, the Suez Canal was the pioneer engineering work of its class, and its cost was doubtless much increased over what it would be now by the necessity for devising fitting plant, by its remoteness from sources of supply and by the European and Oriental political intrigues through which it was carried on. The Corinth Canal was never an attractive commercial undertaking; the preliminary plans were insufficient; contractors became bankrupt; and, in consequence of all these things, high rates had to be paid for money.

In the case of the Manchester Canal, there were heavy expenditures that are not chargeable to the Suez and Corinth canals at all. The battle with opposing interests before Parliament alone cost its promoters about $750,000; the old Bridgewater Canal had to be purchased, at a cost of $15,000,000. The real estate required, the railways, canals and highway to be crossed in this populous country, all entailed enormous expenses that a desert location would have eliminated. The actual contract price for building the canal, and the Manchester docks, was only $28,750,000 in 1887, or about $810,000 per mile upon this basis. But changes in plans, and delay in the work incident to the necessity of raising more money in times of financial stringency, materially and legitimately added to this cost, until the price paid per mile of canal, including the cost of construction, was not less than $1,300,000.

In location the Baltic Canal compares more nearly with the Manchester than with the other two canals. It traverses an old and populous country and is close to the best sources of supply. But here the similarity practically ends. It is a sea-level canal, with tidal locks. The money for it was provided by an autocratic government, with the cost well determined beforehand, so that there was no delay in financing the canal, and the power of a great government was exerted to push it to a rapid and economical finish. Finally, the location seemingly presented fewer engineering difficulties than in the case of its three predecessors; though there were evidently enough of these to wreck the plans and estimates of less careful and conscientious engineers and contractors than those in charge of its execution.

But when all is said, the fact remains that the Baltic is by far the cheapest canal yet constructed

of its class, and it is interesting to attempt to trace out the reasons for this. The first and one of the most important reasons is found in the professional ability of the man who was with the work from start to finish as Chief Engineer, Herr Baensch, who had been prominently identified with the harbor and canal works of North Germany for nearly 40 years. He was a man thoroughly familiar with the class of work to be executed, competent in all respects and exceedingly careful and conscientious in his preliminary plans and estimates, as the agreement of estimates and final results sufficiently prove. While the bulk of the work was done by contract, the same care seems to have been exercised in the selection of these contractors, and, according to the published accounts, a considerable portion of the success of the undertaking must be ascribed to the experience of these contractors and to the ingenious methods devised or carried out by them. For example, the simple and very effective system of sand-dams, used for building the canal through the Haltenau marshes, is said to have been devised by Contractor Hermann Vering, of Hamburg, who constructed the Brunsbuttel locks and nearly one-third of the entire canal.

In some of its features this canal was expensive enough, and it was probably fortunate, viewed from a standpoint of cost, that its location only required two sets of locks; for the Brunsbuttel locks, with their foundations made in 36 ft. of water, cost about $4,000,000, and the Haltenau locks cost $2,250,000. These prices will be interesting bits of information to engineers now planning ship-canals across sections of our own country which necessitate not two, but a number of locks of dimensions suitable for deep-draft vessels. Judging from the general history of the Baltic Canal and the methods prevailing, there was no unnecessary waste of money in these portions of the canal, and the cost of both labor and materials was doubtless much less than prevail in this country. The reports upon the Baltic Canal are not yet published in sufficient detail to permit any safe estimate upon the cost per yard of the canal excavation proper; but one statement makes this average cost about 53 cts., though it is uncertain us to what is included in this price.

Coming back to the cost per mile of the Baltic Canal, it may be said that, with the exception of two high-level bridges on its length of 61½ miles, the very expensive work was concentrated at the two ends in the double-locks, quays and entrances. Thanks to the ingenious methods adopted, the canal itself between the terminals seems to have been very economically constructed. A liberal deduction made for the terminal works and bridges would leave a sum equivalent to about $470,000 per mile for the canal proper and its minor accessories. When we read the history of the engineering difficulties encountered and overcome, in the lock foundations and along the line of the canal, it is difficult yet to understand how Herr Baensch, careful and experienced engineer as he evidently was, could so closely foretell, in 1888, the ultimate cost of this stupendous work. He certainly did give an estimate of cost which was not exceeded, before the work was commenced; and this can only be explained by a most thorough and conscientious preliminary study of all the elements to be dealt with, a thorough familiarity with the country and with works of a like nature in that country, and finally by the greatest care in selecting the contractors and other executives and by eternal vigilance and supervision throughout the conduct of the work. Whatever the cause, the result was a highly satisfactory one, reflects the greatest credit upon the engineer and proves the wisdom of the higher authority that entrusted him with this important duty.

As has been said before, the actual cost of this Baltic Canal is no guide to engineers planning similar structures under very dissimilar conditions. But there is value in feeling that equally intelligent and conscientious work on the part of those in charge of other canals may produce equally satisfactory results, and the promoters of these other canals will find profit in most carefully studying the methods that seemingly prevailed on the German canal.

In applying these results to the proposed Nicaragua Ship-canal, the natural difficulties to be encountered from a tropical climate and surroundings would make any exceedingly close estimate of ultimate cost impossible. But the careful German methods would doubtless very much reduce the margin of error; and as the German engineer on the Baltic Canal must have allowed himself a liberal sum for "contingencies," to cover unforeseen trouble, he would do the same in Nicaragua. In a work necessarily costing many millions, the temptation is strong for the engineer to discount trouble and to figure down the prospective cost to the lowest limit possible, and under-estimates and financial disaster follow too often as a result.

This is the danger to be apprehended at Nicaragua; and it is an eminent danger, unless the "factor of ignorance," naturally a large one in figuring upon an engineering work of these proportions under prevailing conditions, is first reduced to its lowest dimensions. This reduction means the most liberal allowances for exhaustive surveys, plans and study by the most capable and experienced engineers attainable, before a stroke of work is done in the line of construction. We say this with all due credit for the work of this character already performed by the engineers of the Nicaragua Canal. They have done more and better work of this class than stands to the credit of any other canal location on the Isthmus; but much more should be done, and it will be in the line of true economy to do it. The controlling conditions are very peculiar in Nicaragua, unprecedented in canal construction, and nothing but the most exhaustive investigation, study and engineering skill and experience will avoid later changes of plan to meet unforeseen difficulties.

In this connection one of the engineering expedients adopted upon the Baltic Canal would seem to apply to some of the proposed work in Nicaragua. The crossing of the Florida Lagoon and the dam across the San Juan, at Ochoa, are two engineering problems not yet satisfactorily solved by the engineers, and opinions differ widely. One party proposes masonry or concrete structures upon foundations provided in some manner, in the soft ground of the Florida Lagoon, into which a pole can be thrust 70 ft. Other engineers recommend, for both the lagoon and the Ochoa structure, dams of loose rock piled upon the mud until it sinks through, finds a stable bottom for itself and depends ultimately upon its broad base and weight to resist the thrust put upon it when used as a dam. The German engineers successfully used dams of sand in building the canal through the jelly-like marshes of Haltenau; and by first constructing these parallel dams, they certainly did cut off the inflow from the marsh adjoining the canal and enormously decreased the excavation necessary for a canal 30 ft. deep. In Nicaragua sufficient sand is not available, but rock is abundant in the great Divide cut near by, and there seems to be no good reason why similar dams of this loose rock across the Florida Lagoon would not much simplify the canal construction. The chief argument urged against these rock-fill dams in Nicaragua was that they were yet untried as an engineering expedient, and were therefore risky. But the principle has now been successfully tested in the sand-dams of the Baltic Canal; and while the rock may sink deeper and cost more from its volume, it is the best material available, and would probably be far cheaper than any permanent structure of stone or concrete. The Ochoa dam is a different case, for heavy floods have to be withstood. But even here it seems to be only a case of base and weight, and some protection for the top of the completed structure. With the deep foundations required for the dam of stone or concrete, and the difficulties attending the execution of careful work in that region, it would seem safer to depend upon the pile of rock.

This is just the sort of questions, however, which should be exhaustively studied from every point of view before a final plan is adopted, and until that is done, no thoroughly satisfactory estimate of cost can be made. The general dimensions, arrangement and construction of the Nicaragua Canal locks are almost equally unsolved problems, and the cost of those on the Baltic shows the important part these structures play in the final cost of the ship-canal.

LETTERS TO THE EDITOR.

A SUCCESSFUL MUNICIPAL ELECTRIC LIGHT PLANT.

Sir: The chairman of the lighting committee in a prosperous Illinois city drifted into my office the other day for a social chat, and during the conversation incidentally mentioned the very satisfactory performance of the city's street lighting plant, purchased in 1892. The committee were authorized at the outset to buy a 100-light plant, but sufficient funds not having been appropriated to enable them to construct as complete a system of street circuits as desired, they concluded to buy only one 50-light arc dynamo and 50 lamps. For six months this plant was operated by ordinary low-priced employees, but the results attained were of such a satisfactory character that a second 50-light arc dynamo and 50 lamps were purchased, since which date that city has operated 100 lamps at a net cost, including every item chargeable to the lighting fund, of less than $41 per annum.

Yours truly, A. B. J.

Chicago, June 1, 1895.

LOST STREET MONUMENTS.

Sir: In your issue of June 6 "M. H. M." inquires for some means to make city surveys when there are no monuments to measure or range from. I make the following suggestions of methods to be pursued, which I have either discovered or learned by practical experience in city regulating:

In many parts of our large cities "monuments" or "stones" have either not been set or have been graded away, and through negligence of those who should have replaced them have not been reset—much to the trouble of private engineers, who are expected to set "pins" for lot corners.

Very often, if the street has been recently paved, the line of curb may be taken for a "range" or "running line," the transit set up over the edge of curb approximately correct, and then by taking a sight along the curb the head of the transit can be moved until the vertical cross-wire covers the line of the curb. Then the angle can be turned, and, noticing where the line of sight strikes, and making the necessary correction for its distance from the assumed starting point—probably the edge of a brick house or old pin—we can proceed as if we had started from a monument. If there is no new curb we can measure out some offset distance from several well-established brick or stone houses, say, 5 ft., and then, setting over one of these points and sighting or ranging from the others, obtain our "running line." Having our "range line," we can measure up between the said brick houses and see if they are correctly located with respect to one another, and then measure from any one of them to the desired point.

Sometimes old pins of the original plan of lots may be found when the square is new and not entirely built up, and these, when firm and undisturbed, may be utilized. Occasionally the lines and points may be located from some street nearby which has monuments by data in the City Engineer's office, or in the recorded plan of lots (provided it can be depended upon), by turning the angles and making the measurements from such given monuments and data. But, as said before, the method to be pursued must largely be left to the ingenuity of the engineer who is doing the "regulating." Yours respectfully,

A. E. Duckham, C. E.

Pittsburg, Pa., June 15, 1895.

NOTES AND QUERIES.

Will "A Contractor" send us his real name? We cannot notice anonymous communications, but we withhold the name of the writer in publishing letters, when requested.

"Engineer" writes us that he expects to build some chutes for transferring coal from a trestle to a vessel, and asks if these chutes should be curved in order to give the best results. He also asks what kind of a curve should be used, and where he can obtain information as to this class of work.

THE SUBSTITUTION OF ELECTRICITY FOR STEAM ON RAILWAYS.*

In the last three years great extensions have been made in electrical transportation, and it seems well to review briefly the amount of these extensions and their direction, but in this paper I shall consider electric traction as it stands at present and not the possibilities of the future.

In the last seven years electricity has largely taken the place of horses for tramway work, and it is now beginning to replace cables, although the latter have been recently installed at great expense. At first the lines were confined to the limits of towns and cities,

* Abstract of address by Dr. Louis Duncan, President of the American Institute of Electrical Engineers, at the Niagara Falls meeting.

but they have been extended first into the suburbs, and then to neighboring towns, and the extensions have brought them in competition with the steam roads. At first the managers of the larger steam roads ignored the growth of their electrical rivals, but the time has come when they can no longer ignore the decrease in the receipts from their local passenger travel, and they are beginning to face the difficulty and to carefully study the situation.

In order that it should pay a railway to make a change in its motive power, the effect of the change must be either to increase the receipts or decrease the expenses by an amount equal to the interest on the first of the change. Practically, the amount should be greater in order to justify the change, to take into account those elements not capable of exact calculation, and also the fact that an increase in the fixed charges of a road is a more serious matter than the mere amount of it, for although the average for a number of years might show a gain by the substitution of electricity, in a bad year the increased fixed charge might cause difficulty.

There are two very distinct sides to the question of transportation, the passenger side and the freight side, and their requirements for good service are very different.

First, taking up the question of passenger travel. The receipts of a road are increased by running trains at short intervals and at high speeds, and this is a condition peculiarly favorable to electricity. On an electric line short trains equally distributed over the track give a greater station efficiency, and the lowest cost of equipment of both station and line. The cost of train service is somewhat greater, but is compensated by the saving in the other items.

The cost of hauling a given number of passengers between given points by steam is greatly increased when the number of trains is increased. The efficiency is less, and the cost of equipment and of train service is greater. Wellington states that doubling the number of engines for a given traffic increases the cost of transportation about 50%.

On the other hand, if we take up the question of freight traffic, the conditions of greatest economy are reached when trains of a maximum weight are hauled by a single locomotive. The tendency in late years has been in the direction of increasing the size of the locomotive, the capacity of the cars and the length of the trains. These changes have necessitated more solid and expensive road beds, heavier rails and general strengthening of bridges. The outlay has been enormous, but the decreased cost per ton-mile for freight transportation has shown the wisdom of the change. In attempting to carry on traffic of this kind by electrical locomotives operated from a central station, we are at a great disadvantage because of the irregular service necessitated by the freight traffic and the unequal distribution of the load along the line. Suppose, for instance, that there were two stations supplying the line and that the traffic was uniformly distributed along it, then the capacity of each station would be one-half of the total required capacity. Suppose, however, that the entire traffic was concentrated in one train, then each station would have to have a capacity equal to the total power required for hauling the entire traffic, as the train would be first supplied from one station, and then from the other. The line also would have to have a capacity suitable for handling the total traffic. If a number of heavy trains were used, and the traffic was irregular and liable to be congested at one point, as in the case of freight service, then again the capacity of the stations would have to be greater than that required to supply one-half of the normal traffic. If we were to decide to transmit the current to a longer distance and to supply all the track from one station using transformer devices along the line, then the capacity of the station itself would only be that required for the normal traffic of the line, but the transformer devices would have to be sufficient to handle the maximum traffic of the section which they supplied, and would have to be given a capacity greatly in excess of their average load in order to supply this energy. We must distinctly bear in mind in considering the application of electricity to steam roads that any departure from a uniform distribution of load along the line will increase both the cost of equipment and the cost of operation.

The amount of freight transported per train-mile has more than doubled, and the expense has decreased more than one-half. The passengers per train-mile, on the other hand, have decreased, and the expenses have changed only a slight amount, notwithstanding the greater economies that have been put in force in the interval. Passenger traffic has come in the direction in which electricity is the most economical for transportation; freight traffic, on the other hand, has gone in the direction where electricity becomes most costly. It might be argued that some new scheme for freight transportation by electricity might be used, but it would be difficult to devise any system more economical than that at present in use, and the great amount of through traffic on freight lines precludes the possibility of devising any system which differs radically from that at present in use.

It seems to me, as matters now stand, it will not pay trunk lines to change the method of operation for freight traffic, and the question to be considered would be the operating of the lines partly by steam and partly by electricity. Let us consider if it is possible to run the passenger service wholly or partly by electricity. Considering a two-track road doing a through as well as a local business, I think we can decide that, unless the case be an exceptional one, it will not pay to equip the main line electrically. It is necessary that the through express service be continued and that the freight service be continued, and an attempt to operate the local trains with the through trains could not be successful if there was any considerable amount of through traffic. With a four-track road the condition of affairs is somewhat different. If the road operates between cities acting as terminal points for all passenger traffic, as with some of the lines between Boston and New York, then by equipping all four tracks it would be possible to run express service at short intervals on two of the tracks, and on the other two tracks to run freight and local trains. At present it would not pay to use electric locomotives operated from a central station for the freight service, but the local service could be operated electrically; and as the speed of the local trains would be approximately equal to that of the freight, there need be no serious interference with the traffic. We would then have express passenger service working under favorable conditions —that is, with a number of trains evenly distributed, a local service operated under similar favorable conditions, and with no interruption to the freight traffic. If the road, however, is to transport a considerable number of foreign cars, as, for example, the New York Central or the Pennsylvania railway, then the condition of affairs for express service would not be so favorable, and the question of the equipment of the tracks for express service would have to be carefully considered. As far as the branch lines go, whether it would pay to partially or wholly substitute electricity for steam depends upon the local conditions. A long branch with a small amount of local traffic it would not pay to equip, but on a short branch with considerable passenger traffic and comparatively little freight traffic such equipment would pay.

There are certain kinds of local traffic which the steam roads must, to a large extent, lose, and which in the nature of things they cannot regain. In large cities having a considerable suburban traffic the trolley roads, forming as they do a network of lines within the city and extending in every direction into the suburbs, offer advantages with which the steam roads cannot compete. In Philadelphia, one of the large steam lines lost so much traffic that it has attempted to regain it by reducing prices and increasing the number of trains. In this effort it has partly succeeded, but at the cost of greated expenses and decreased receipts. To counterbalance this loss at central points, railways may hope, by the introduction of electricity, to increase their earnings along the lines and on their branches.

As to the nature of the equipment that will be required, it would depend on the work to be done and the branch that is to be equipped. In some cases it might be well to use single electric cars running on the steam tracks between towns and on the local tram lines in the towns. As the speed would be very different in the towns and on the railway line, and as the voltage could also be different, it would be well in this case to use a number of motors on the car, and to use a series parallel controller, the motors being in series for the town traffic. For instance, suppose we wish to run at a maximum speed of 40 miles per hour between two towns, and it is economical to use 1,000 volts on the line, we could use two motors on the car, run them in parallel on the main line at a speed of 40 miles per hour, while in town, with a voltage of 500, we could run them in series at a speed of 10 miles per hour. I can hardly imagine a case where the three-wire system could be economically used for such service on the steam lines.

The condition of affairs in electric transportation is at present curious. The trolley companies, by extending their lines, are working from tramway transportation to through transportation. They are attacking the problem by development from small motors to larger ones. The railway companies starting with the large units are coming down in the direction of the present trolley systems, as in the case of the Nantasket Beach branch of the New York, New Haven & Hartford R. R. Perhaps in the future they will meet and some standard electrical system will be adopted for the present steam road. I think then, that in the case taken up, the policy of the road will be to equip those branches for which the conditions are favorable with a trolley, run comparatively large motor cars capable of drawing one or two ordinary passenger or freight cars as trailers, using the present steam service for their freight traffic when necessary. This will allow the necessary through travel, will give the required local service between towns and will not interfere with the freight traffic.

As for the systems to be used for such services, I believe that at the present moment the continuous current overhead trolley system is the only one that can be selected with a certainty of successful operation. In most cases of roads built for an entirely new electrical equipment such, for instance, as the elevated roads in Chicago, and the underground rapid transit road in New York, or the proposed Washington-Baltimore Boulevard line, the traffic is almost entirely a passenger traffic, and the conditions are especially favorable for the operation of electricity. Taking, first, the case of the New York underground road, there will probably be required about 150 trains for local service, each train having five ordinary cars and a motor car. For the express service there would be about 25 trains of, say, four ordinary cars with a motor car. For this it would probably be best to use the direct-current three-wire system, one of the cars on the train being equipped with motors and acting as a locomotive. With four motors on a car the system would be efficient at all practical speeds, and if desired a large part of the energy could be thrown back on the line when the cars are being stopped. In the case of the local trains, a simple calculation will show that a very small part of the total energy expended is used in overcoming the track resistance, while a very considerable part is employed in accelerating the train and afterward wasted by braking. I have calculated the amount of energy which can be practically saved under the conditions of local and express traffic on the New York underground road, and find that with motors of ordinary efficiency about 45% can be returned. If storage batteries are used in connection with the central stations, the batteries being located along the line, a uniform load can be thrown on the stations, and their capacity may be reduced to almost one-half, as compared with a system in which the energy is not returned, thus greatly decreasing both the expense of installation and of operation. As it is possible at present to obtain batteries with a rapid discharge rate at very reasonable prices and with a guarantee for repairs that place them well within the limit of commercial calculations, a system of this kind offers some advantages over any other system that could be applied to the operation of the underground road. An alternating current would hardly be economical for this work, as it precludes the possibility of returning the energy to the line, and as the variable speed required makes it uneconomical as compared with the direct-current system using, say, four motors with series parallel control. In the case above cited, shunt motors would be used, and it would be possible to get a contact with the line that could not under any circumstances be broken. The case of the elevated roads is very similar to the one I have cited, except that in existing structures shorter trains would be used, and the cost of equipment for a given number of cars would be somewhat greater.

The immense locomotive for the Baltimore Belt Line tunnel is the first instance of the direct displacement of steam by electricity, and the line over which it is to be operated is the first through steam line to be equipped electrically. It seems to me that the present is a crisis in the history of railways. Up to the present the steam roads have ignored the competition of electric roads or they have fought them. To-day they cannot afford to do either. In a few years electric roads will have absorbed practically all of the local traffic, and will begin to cut into through transportation. The steam roads cannot afford this, and their only safety is to make of electricity an ally instead of an enemy, and this before it is too late.

The conclusions that I finally reach are:

1. The tendency of passenger transportation on the steam lines has been in the direction of the greatest electrical economy, while the tendency of the freight transportation has been in the direction of the least electrical economy.

2. It will not pay any through line with considerable traffic, having two tracks, to equip its main tracks electrically.

3. With four-track roads it will pay to equip all of the tracks electrically unless a considerable portion of the business is through passenger traffic.

4. It will pay all the larger roads either to equip a number of their branch lines electrically, or to control competing electric lines.

5. In order to remain on a dividend-paying basis it is imperative that most of the two-track lines either build additional tracks or control the electric railways that parallel them.

6. Believing that ultimately all of the traffic will be done by electricity, it is imperative that the managers of steam roads keep in touch with electrical progress.

The Corinth Canal is said to have earned only $65,365 in the 14 months it has been in operation, while its operating expenses have been $62,483. The fixed charges for that period are about $600,000.

THE HYDRAULIC JUMP.*

By Robert Ferriday, South Bethlehem, Pa., Graduate of Lehigh University.

If the level of a stream is raised by a dam, we have the condition shown in Fig. 1 (the vertical scale being exaggerated). The surface of the water will rise from the dam backwards, as shown in Fig. 1, A B being a horizontal line tangent to the curve of the overflowing water.

According to De Volson Wood, this elevation of the surface is called backwater and also a "remon." It is caused, he states, partly by the inertia of the liquid and partly by its viscosity. As the stream approaches the dam its velocity is checked, because the pressure on the front side of a particle exceeds that on the rear side. When the velocity is thus reduced the particles offer a resistance to those which follow, and thus the resistance is extended up-stream. The resistance due to viscosity still further increases this effect.

If the stream is rapid compared with its depth, the backwater will be modified, presenting an appearance similar to that shown in Fig. 2. It is this phase of backwater that this thesis will take up. The point, A, Fig. 2, was called "l'origine du remon." In this thesis it will be called the hydraulic jump.

The first precise measurements of the hydraulic jump were made in the Hydraulic Laboratory at the Universite Royale in France in 1818, by Geo. Bidone. The results were published in 1819 by the Royal Society of Turin. Bidone sought to establish a formula which would express the theoretical height of the jump.

Belanger is credited by Grashof, in his "Maschinenlehre," Vol. II., p. 784, with advancing a theory in 1838 with reference to the height of jump. In Bennett's translation of d'Aubuisson's "Treatise on Hydraulics" (p. 187 of New York edition of 1857), a formula for the jump is credited to Belanger.

In Du Bois' translation of Weisbach, Vol. II., p. 130 (New York, 1877), the latter claims to have published the formula for the backwater curve in 1844. I am led to believe that this author's formula for the jump, given on p. 124 of the above volume, was published at the same time.

In "Recherches Hydrauliques," by Darcy, part I., pp. 284-96 (Paris, 1865), we find the record of a very extensive set of experiments by that author in 1856 and 1858. He deduces a formula for the height of the jump.

Bresse, in "Cours de Mecanique Appliquee," vol. II., p. 302 (Paris, 1868), gives a formula for the height of the jump and in the preceding pages an equation for the backwater curve. Grashof and Ruehlmann both make reference to the appearance of the equation in an edition of 1860, so I place that as the date.

Grashof gives an unsatisfactory empirical formula in his "Maschinenlehre," vol. I., pp. 787-8 (Leipzig, 1875).

In the Encyclopedia Britannica under "Hydraulics" Unwin gives (1881) a little more concisely than Bresse the deduction of the same formula for height of jump.

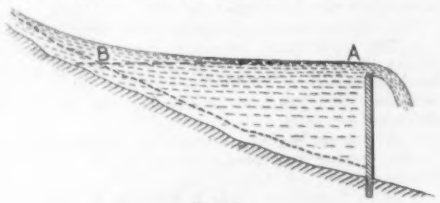


Fig. 1.

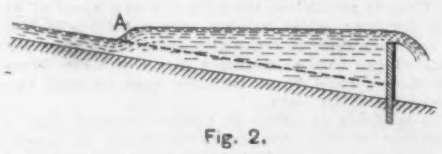


Fig. 2.

DIAGRAMS ILLUSTRATING BACK WATER CAUSED BY DAMS.

(The author next devotes 55 pages to building up an equation for the backwater curve, discussing the same and the equations of the writers mentioned above. In building up this equation the author states that the general mode of procedure was derived from Merriman's "Hydraulics" (New York, 1893), as was also the equation for the height of the jump. The author recapitulates his discussion of Merriman's equation and his application of the same as follows, stating further on that his experiments bear out the deductions.—Ed.):

The purpose of this thesis is to compare observed measurements of the hydraulic jump with those given by a theoretic discussion.

(1) The height of the jump (A, Fig. 2) is increased either by increasing the inclination or discharge, or both together. (2) The extent of the backwater is increased by increasing the height of the dam or by decreasing the inclination. (3) The extent of the backwater is decreased by an increase in the height of the jump, so that increasing the discharges decreases the extent of the backwater. (4) The stream above the jump is under the same conditions before and after the introduction of the dam. In order to form the jump the velocity must be greater than $\sqrt{q\,D}$ (discharge into depth of stream without dam), which necessitates an inclination equal to or greater than 0.00268.

The apparatus used in the experiments was designed and made by the author. The general arrangement is shown in Fig. 3. The trough was made of planed white pine boards. The dams were of the same material and had weir edges. The dams were placed at an angle of not quite 90° with the bottom of the trough so that they would be as nearly vertical as possible in all positions, being at the mean for the limits of the inclinations of the trough 0.0 and 0.08 ft. In measuring depths readings were taken to the top of the water by means of a graduated iron scale, with proper guides. In the feeding dam above the trough there was a weir and waste weir, the latter for regulating the discharge. The idea was to have three discharges constant during the series of four inclinations, and with each inclination a series of six dams. It was found impossible to keep the discharges constant, as the stream flow varied. The means of the discharges at the beginning and end of each experiment were therefore used. The jumps and the extent of backwater were measured at the side and middle, and the means computed. The dams were in all cases higher than the depth of the water, so that there was a free fall after passing over the dams.

The following was observed: On the introduction of the dam there seemed to be two forces at work, the moving water tending to cause motion in one direction and the static head, caused by the raising of the water, tending to cause motion in the opposite direction. The jump moved back just so long as the head on the water below the jump overcame the dynamic action of the water above. When the water poured over the dam, the static head ceased to increase, and these two forces becoming equal caused a permanent position of the jump. It seemed to the writer that these were the two forces at work, and that the cause of the "standing wave," or jump was the dynamic action of the water above the jump.

The highest point of the backwater in most cases was about 0.4 or 0.5 ft. back of the dam. This depth corresponds to the depth at the dam, as, of course, the crest curve prevents any measurements immediately at the dam. At the jump the surface of the water was convex.

The equation of the backwater curve, originally deduced by Bresse, was used in comparing the theoretical with the observed extent of backwater (the proper conditions having been introduced which made it applicable to the hydraulic jump). The computed and observed values of the extent of backwater in all the experiments agreed very closely. The computed values were always equal to or greater than the observed values. This fact, and the consideration that the formula does not take into account the energy lost in waves and foam, leads me to believe that the equation of the backwater curve is correct. A simple experimental method for testing the validity of a theoretical formula is always to be desired, so the author, understanding that the backwater curve plays an important part in questions of riparian rights, and that experiments with it are difficult to perform, offers the hydraulic jump as a means for testing that equation.

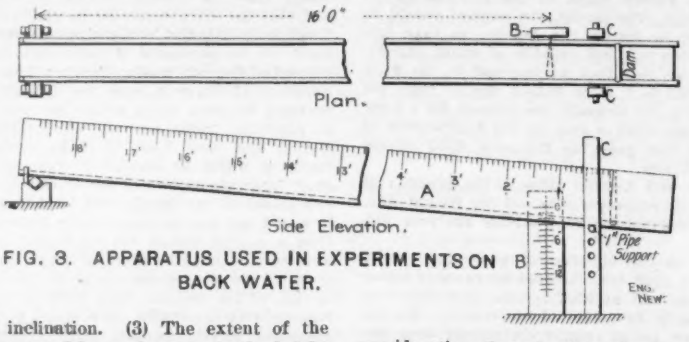


FIG. 3. APPARATUS USED IN EXPERIMENTS ON BACK WATER.

A graphical representation of the depth below jump, computed in accordance with the formulas of the authors cited above, and also plotted from the experiments, shows that the formulas of Belanger, Weisbach, Ruehlmann, Graeff and Bidone fail when the jump is high or when the velocity and discharge are great. We can see from this that they are deficient because they do not consider impact, which Merriman, Bresse and Unwin do consider. Merriman goes further and considers the energy expended in lifting the water. This is where the writer sees the superiority of Merriman's formula, the agreement between theory and practice being closest with his formula. Bresse's formula is good only where the depths are small, but Merriman's holds good throughout.

* Graduating Thesis Awarded Third Honorable Mention in Engineering News Thesis Competition for 1894. The thesis as here given is in a much condensed form, with many of the illustrations and long mathematical discussions omitted.

CUTTING OFF DITCHES ON THE BALTIC SHIP CANAL.

Where the Baltic and North Sea Ship Canal traversed the marshes of the Holstenau, the surface was a mossy turf, with sand and mud beneath, and in places the marsh had a jelly-like consistency incapable of supporting anything. As described in our issue of Aug. 1, 1891, the canal excavation was carried through this soft ground by first forming parallel sand dams and excavating the material within these dams by dredging machines.

But beneath the turf and other material, at depths down to 33 ft., was a marl deposit, called klai, and to get at this for fertilizing purposes the farmers had cut, with a peculiar kind of ditching machine, trenches of a maximum depth of 34 ft. and nearly 1½ ft. wide. Where these ditches intersected the canal leakage was feared, and the engineers required them to be filled up. This was done by first lowering a pipe 11.4 ins. in diameter into the ditch, and forcing it down by a small ram. This pipe was then filled half with water and half with sand, the water being used to make the sand flow more easily. The pipe was then raised, and in this way a sand cone was formed in the ditch extending to the surface. Across the ditch and through the sand cone a row of piles 6 to 10 ft. wide was driven, with the end of the piles entering 3 ft. or more into the firm soil beneath. In all 23 of these ditches were thus cut off at a cost of from $60 to $140 each, and the most careful inspection has failed to detect any leakage through them from the canal. London "Engineering" credits

Mr. Hermann Vering, of Hamburg, with devising the ingenious and novel system of sand dams employed in this work. Mr. Vering built the Brunsbuttel locks, quays and moles, and almost one-third of the canal.

FREIGHT STATIONS AND YARDS ON ENGLISH RAILWAYS.*

The freight traffic of the large cities in England is so vast that it is necessary for each of the railways in these places to have several stations, for the convenience of shippers, the reduction of cartage expenses, and for expeditious means of dealing with the traffic. There are but few towns of moderate pretensions that are not served by more than one railway, each having its own station.

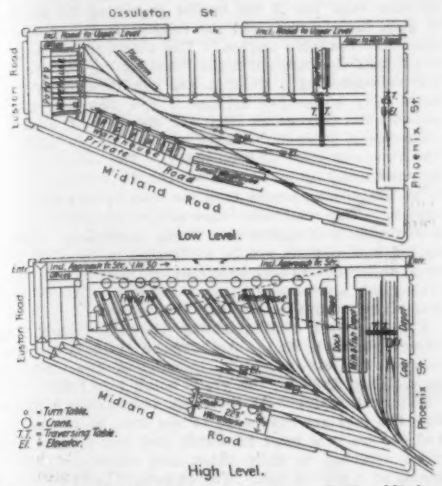


Fig. 1. Plan of Freight Station of the Midland Railway at Somers Town, London.

The growth of traffic has necessitated a considerable duplication of lines in some cases for the separation of fast passenger and freight trains from slow trains, and in other cases for the accommodation of a heavy mineral traffic, and separate branch lines are sometimes provided to accommodate freight and mineral trains in the neighborhood of large stations and yards. The working is also greatly assisted in several cases by avoiding grade crossings of main tracks by tracks leading to separate yards, etc. Thus, where there are separate groups of sidings for incoming and outgoing traffic, the connecting lines may be laid out to cross over or under the main tracks.

The handling of "carted" traffic, or traffic carried at rates which include collection and delivery, either by the railway companies' own teams, or those of their agents, is, generally speaking, performed by the companies' own employees. "Not carted" or "station to station" traffic consists generally of heavy traffic conveyed in quantities of not less than one ton, and is, as a rule, carted and handled by the senders and consignees. On arrival at its destination, the railway company's agent advises the consignee that the traffic is awaiting his orders, and that unless the truck be emptied within 48 hours, a charge of 75 cts. per day for demurrage upon the wagon, and 12 cts. upon the sheet (when used**) will be made until the traffic is cleared. Under similar circumstances in the case of owners' wagons, siding rent is charged, as for the occupation of the rails. In yards, wharves, sheds, and marshalling sidings, with few exceptions, all the switches are worked by hand-levers, which are either held by the hand or pegged over, or held in position by a heavily weighted handle, the latter being the most usual. The siding connection with the main passenger tracks is in all cases worked and controlled by the signalman from his cabin.

Freight Yards.—The largest yards are sometimes situated on small branch lines specialy made for them, or were originally constructed as terminals for both passenger and goods traffic and were afterwards discarded for passenger purposes owing to the growth of the traffic. Turntables, worked by hydraulic capstans, are employed for marshaling purposes and performing a large amount of the yard shunting in several of the London & Northwestern Ry. yards, and this mode of working is best seen at Camden (London). It has, also, been adopted by the Manchester, Sheffield & Lincolnshire Ry. at the Grimsby Docks for the placing of cars on the various wharves where an engine could not work; and the London, Brighton & South Coast Ry. performs most of its work at Deptford Wharf, London, by similar means. Generally, however, in both warehouses and yards, turntables and horses are only used in cases of necessity, and in all modern station improvements they are abolished where practicable, and the lines and sidings so arranged as to admit of the whole of the switching being performed by switch engines, or by gravity.

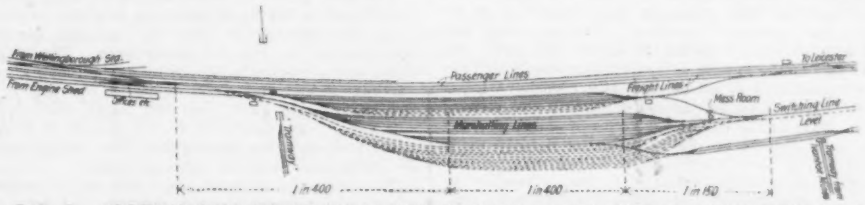


FIG. 2. SORTING SIDINGS AT WELLINGBOROUGH; MIDLAND RAILWAY, ENGLAND.

The switching engine of the best type is as powerful as the largest train engine, and is specially adapted for its work. It has no tender, and carries its coal in a small bunker in the rear. It is about 29 ft. long, and adapted for getting round sharp curves. It weighs about 35 gross tons empty, and 40 tons when supplied with coal and water. It has six wheels, all coupled, and is fitted with a steam brake, which enables it to be stopped quickly, and is in charge of an engineman and fireman. Its workings are controlled by a man called a head-shunter (or switchman), who is assisted by one or more under-shunters. The coupling and uncoupling of the cars in switching is now largely facilitated by the use of a pole with a hook, a recent invention, and which, except in rare cases, renders it unnecessary for a man to go between the cars for the purpose of coupling and uncoupling. In England the freight cars are not fitted with automatic or non-automatic mechanical coupling appliances.*

A freight train on arrival at an important yard, is taken over by the train-receivers, or shunters. The engine and train-men go off duty and the cars are placed by a switching engine in position to be unloaded or loaded. Where switching engines do not work in the shed, cars for the warehouse are so set that the shed staff with the aid of hydraulic capstans can easily dispose of them; others may be wanted in different parts of the yard, and are put in position as time and opportunity serve, and according to the relative importance of the traffic.

Sidings which are arranged for heavy traffic, and in which cars are placed to be reached by the public who cart the traffic to and from the cars, cannot be switched very much during the day without inconvenience and hindrance, and every effort is made to accomplish this switching with as little friction as possible, reserving the bulk of the work to be done during the night, when the yard is closed to the public. The cars which are emptied or loaded for their outward journey have, in the same way, to be switched out when most convenient, and according to the requirements of the public, the yard working, and the train service, and when ready are set either in sidings specially reserved for them, or are placed on the most available lines with the cars loaded in and sent from the shed, and formed into train loads for their respective destinations.

Where, however, there is not sufficient room to make the various sortings for all the trains running from the station, or district, the wagons are sent to the nearest marshaling or sorting yard.

Cranes, fixed or movable, are supplied according to necessity, and their size and strength are in proportion to the work to be done. Ordinary cranes to lift weights varying from 1½ to 20 tons, are actuated by either hand, steam or hydraulic power. Where the traffic needs them, traveling cranes are erected, and have a travel of 70 ft. or upwards over the cars. They combine a steam engine and crane, and lift weights from 20 to 40 tons. Locomotive steam cranes, such as are used by railway contractors, are also employed. Cranes fixed on ordinary cart-wheels are found very serviceable, as they lift from 1 to 1½ tons and can be moved by a horse and placed where wanted in the yard alongside the track.

The heaviest weights, 70 to 100 tons, are lifted at shipping ports by means of shear-legs worked by hydraulic power or by separate steam engines. At Southampton harbor two steam cranes have been superseded by electric cranes each of which will lift a maximum load of 3 tons at a vertical speed of 100 ft. per minute, or a load of two tons at 200 ft. per minute, with a rotating speed of about 600 ft. per minute. The cranes have a radius of 27 ft. 6 ins. and 32 ft. 6 ins. respectively. The power is obtained from the local electric lighting company, which laid a special wire from its station about half-a-mile distant. These electric cranes are very expensive both in construction and maintenance, although the cost of the latter will doubtless be reduced shortly. At present, however, sufficient experience has not been gained to recommend their general adoption.

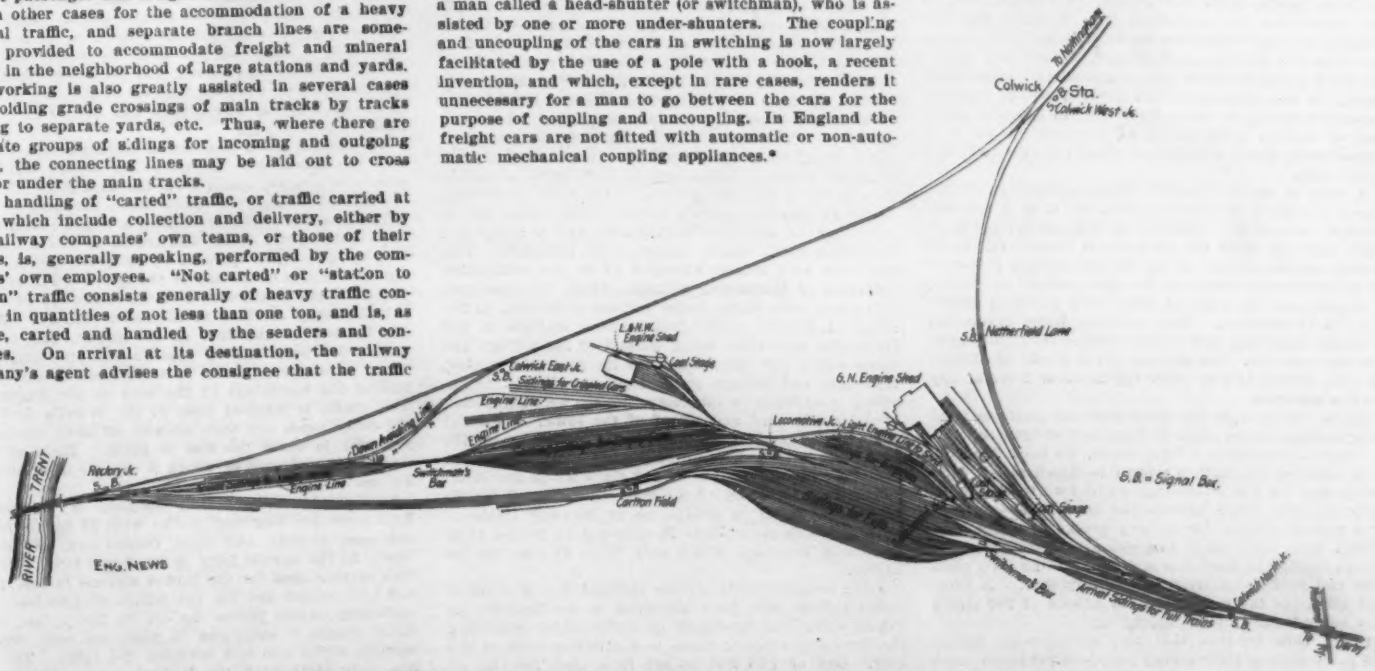


FIG. 3. FREIGHT YARDS AT COLWICK; GREAT NORTHERN RY., ENGLAND.

* Abstract of a report prepared for the International Railway Congress by Mr. George H. Turner, General Manager of the Midland Railway, England.

** The sheet is the tarpaulin covering used to protect the goods on the open freight cars which are more general than box or closed freight cars.—Ed.

* The coupling is almost invariably by loose chains over the hooked ends of the drawbars.

The important railway yards, at present, are chiefly lighted with gas, but in a few cases Wells' oil light is used, and electricity has also been adopted. A number of our large depots, offices, warehouses, yards and sidings, are now so well lighted in the absence of daylight, that the work, on the whole, is performed as efficiently and expeditiously and with an equal if not a greater degree of safety than in broad daylight. Electricity is an almost perfect illuminant, and has been proved to be far better than gas for the purpose. By its co-operation, the staff can read the marks, etc., on the addresses and consignment notes during the night-time as readily as during the day; the checking is performed with ease, compared to former times, when each checker carried a small lamp, which not only gave but a dim light, but occupied one hand, whilst now both hands are at liberty.

To accelerate the handling and transit of goods, and to simplify the separation of those for delivery or despatch from those requiring to be stored, it is desirable that, wherever practicable, the warehouse and shed accommodation should be under one roof. We have adopted the system of having the warehouse over the working shed at all our recently remodeled goods stations. Furthermore, instead of loading and unloading the drays at the end of the series of stages or platforms in the sheds, we have considered it to be more serviceable to have cart-roads at either side of the platforms to their entire length, so that a number of teams can be unloaded and loaded simultaneously, opposite the trucks. This does away with the slow and laborious barrowing which has to be performed in sheds where the teams pick up or set down at the end of the platforms instead of the sides. This refers to the treatment of carted traffic. Sidings should be provided, either inside the sheds or under awnings alongside, in which grain, flour or other full loads of "station to station" traffic liable to be damaged by wet can be dealt with under cover. Covered space of this character is a valuable accessory, and I do not regard any modern goods station in which it is not provided as complete.

The cart-roads between loading and unloading stages inside the sheds should always be paved with wood blocks. Our experience proves that teams can back drays into position at the platform side with a minimum amount of energy over a wood pavement, but an even greater advantage is the absence of noise, which enables the calling off and checking of goods to be effected with greater comfort and accuracy.

Another point to be considered is direct connection between goods sheds and sidings, in contradistinction to connection by turntables. The Midland Ry. has abolished these turntables wherever practicable, and in no case are we introducing them in our new or remodeled stations where they can possibly be dispensed with. In this respect, as will be seen, we effect an appreciable saving in horse traction. In the high-pressure of modern working, in which every minute is of importance, direct connection, wherever available, is a great gain.

A plan of the Midland Ry.'s new station at Somers Town (London), is shown in Fig. 1. It is a terminal station, served by railways or sidings diverging to right and left from the main goods lines. Of the 32 sidings which pertain to the freight station proper, 6 terminate in stop-blocks in the open, and 26 end within a freight shed the sides of which they pierce in pairs—i. e., in 13 openings. They all have direct connection with the main line, and contain neither turntable, hawser, nor capstans. The placing of the trucks is effected by locomotives, and no other appliance or force of any kind is required.

Within the shed is the usual elevated platform level with the floor of the cars, with an area of 8,000 sq. yds. In shape it resembles a huge comb, its back 200 yds. long, forming the main platform to which street vans are backed up for unloading, while its teeth are 13 branches, each space between the teeth being occupied by a pair of sidings for railway trucks in direct connection with main lines, as previously described. The sidings inside the shed run each alongside its own platform and hold collectively 180 railway cars. A cart-road alongside the main platform admits of 100 street vans being backed up for unloading.

It will thus be seen that this arrangement brings into juxtaposition for working purposes 100 street vans and 180 railway cars, all of which may be in course of unloading or loading at one and the same time. Any one of the 100 vans may contain goods for any one or all of the 180 trucks, and 100 multiplied by 180, which equals 18,000, represents the possible simultaneous operations without double handling, although that extent is never approached in practice.*

The branch platforms are allocated to given districts, and agree as far as possible with the order in which trains are made up nd despatched. The cars as they stand in the sidings or loading berths have name plates hung upon them, showing their respective destinations; and there are, in addition, indicators, or finger posts at the entrance to each platform, showing the consecutive number of the platform and the name of its district. Thus, a strange porter sent with goods from the unloading side need only know the number of the berth required, to be able to find it as readily as an experienced man, and, again, the trucks when loaded want little or no marshalling to get them into train order. As a rule they stand in the loading berths in the same order as they are required on the train. The main platform where vans are unloaded, are furnished with cranes, worked by hydraulic power, which vary in lifting capacity from 1½ to 2 tons. Near the end of the main platform is an opening, through which is a continuation of the cart-road to admit of full loads of goods which do not require distributing being brought alongside trucks standing in sidings and loaded direct from vans to trucks.

The shed is 760 ft. long and 250 ft. wide in center, contracted to 180 ft. at each end, in order to admit of two cart-roads which form the entrance for loaded vehicles and the exit for empty ones. The height is 25 ft. and the place is lighted by day through a roof of corrugated iron and glass, supported by girders resting on the side walls, and two intermediate rows of columns at intervals of 35 ft., so that there is an unusual freedom from obstruction. The electric lighting arrangements are on an elaborate scale.

The basement is upon the level of the adjoining streets and forms a covered railway yard with space for 600 railway cars, and very ample roadways for street vehicles. Access from the railway is obtained by three hydraulic lifts, each of 20 tons capacity, for lowering and raising the cars from and to the level of the main lines of railway. In the low level, a large potato and other traffic is also dealt with. The cars on which it arrives on the high level are lowered by hydraulic power and placed in the sidings to wait until the potatoes are required by the tenants of the warehouses which have been provided by the company and which are also on the low, or street, level. They are admirably adapted to the wholesale trade, and are let to potato merchants at fixed rentals. This basement or low level also contains three pairs of steam pumping engines with accumulators for maintaining hydraulic force and two pairs of engines driving Thomson-Houston dynamos for lighting this and adjoining goods and passenger stations.

At small stations ordinary hand-cranes are only provided where needed; traveling cranes with special loaders being sent from headquarters to deal with occasional consignments of timber and other heavy traffic which requires special facilities. The yards and sheds of such stations are so arranged as to be daily switched by train engines. Should any cars require moving when an engine is not there, they have to be pushed by men, or propelled by either a hand-lever 6 ft long, or a crow-bar. Little or no difficulty is experienced in this respect. It is desirable, on important main lines, that, at all roadside freight and mineral stations, stopping trains having work to do should be able to set in the sidings clear of the main track; and, as far as possible, engines should, in switching, not be compelled to foul the main track, and a lie-by and switching track should therefore be provided. This has been very largely attended to by the companies.

Sorting or Marshaling Sidings.—These are constructed to deal with traffic under various conditions, as follows: 1. Freight traffic from several stations in one large city, the traffic being worked to the sidings and there sorted and marshalled for its respective trains; 2. Freight and mineral traffic from one district to another, in addition to supplementing the accommodation of the goods shed and wharf of the town; 3. Freight and mineral traffic from one district to another on the same line which has to be sorted and worked on through trains to destination; 4. Cars which are interchanged at junctions of different railways; 5. Traffic exchanged owing to grades, as at Rowsley (Midland Ry.), to which place 32 to 38 cars can be hauled from the south, but from which only 18 to 22 cars can be hauled.

Quite recently yards on the Midland Ry. with dead-ended sidings have been improved, in one instance by taking away the dead-ends or buffer-stops, extending the lines and coupling them to a shunting neck at the rear. One or two sidings are then used for the reception of the trains, as before, out of which the shunting engine in the rear can take the wagons, and dispose of them into the various roads, whilst an engine can also be working at the other end, either in disposing of the wagons or attaching an outward train. A fan of sorting sidings at Wellingborough with buffer-stops was superseded a few months ago by a lot of new sidings formed partly on the gravitation principle, the design of which, from the point of view of the cost of construction and utility, recommends itself as generally suitable for easy gradients where gravitation is needed. From the plan, Fig. 2, it will be seen that the sidings are placed alongside the up-freight line, and consist of six reception sidings, each holding from 52 to 63 wagons, and 11 sorting sidings with a shunting siding at each end. Room is left for 14 additional sidings in the future.

The sidings are numbered 1 to 6 and 10 to 20 respectively, and are arranged to deal with coal traffic, which usually arrives in train loads of 38 wagons. A train for the sidings is turned on to one of the reception lines. The engine is liberated immediately; the examiners test the cars and attend to the grease boxes; the train-receiver chalks on each wagon (or the leading wagon of several for the same place when they happen to be together) the number of the destined siding; the shunting engine takes off the caboose in the rear of the train, and shunts it down an empty reception line for the train-engine to take with it if it has to return with another trip, but if the engine is put up at the shed it goes there direct, and the caboose is disposed of by the next available engine. The shunting engine then takes half the cars on to the shunting line, where they are uncoupled by a shunter, and run off by gravitation into their respective sidings. The shunting engine follows the wagons as they are disposed of, sufficient time being allowed between uncoupling to admit of their running clear of each other. The shunters regulate the speed by pinning down the lever brakes on the cars, for which purpose they use brake-sticks when necessary. The remaining cars are afterwards fetched, and similarly disposed of. These operations with 38 loaded coal wagons can be performed in about 10 minutes under favorable conditions of weather; but four trains per hour make a good average. About 1,500 wagons per day pass through the sidings.

Fig. 3 shows a plan of the Colwick freight yard (Great Northern Ry.). An inbound train is run onto one of the six reception lines, and the cars are switched by gravity, the grade being 1 to 1.25%.

Shipment of Coal.—At the Leith Docks (North British Ry.) the cars are drawn on to the level of the harbor, and run on to a hoist to which they are secured by a chain attached to their axles, and otherwise held by means of a curved rail. The end-doors are unfastened and swing open, and the hoist is raised and tilted, throwing the coal into the vessel. The hoist, with the car, then falls back to its normal position, and the car runs away by gravitation. From 20 to 30 cars per hour can be discharged by these means at each hoist. At Liverpool North Docks the Lancashire & Yorkshire Ry. loads vessels with coal both by means of hydraulic cranes, and a tip-end and shoot similar to those at Leith Docks. The cars are mostly constructed with three boxes which rest on the car frame. These boxes have doors underneath, and are fitted with hooks with which they are lifted by the cranes, and chains with which the cranes open the bottom doors. Each crane has two chains to accommodate itself to the boxes, one by which it lifts the box over the vessel and regulates its descent and ascent, and the other which opens the bottom door to allow the coal to fall out. By these means each of the nine cranes can unload 15 cars per hour.

At Garston Dock (London & Northwestern Ry.) the cars are taken over the quays on arches which terminate in a tower rising from the dock side. The rails are carried through the tower onto a platform or cradle which projects rather more than a wagon's length over the water in the dock. The cradle is raised and lowered by wire ropes operated by hydraulic power, working over sheavs in the cap of the tower. The ropes attached to the outer corners of the cradle can be worked independently of those at the inner corners. Vessels are berthed at the foot of the tower, and when a wagon has been run by capstan onto the cradle, the latter is lowered, a man in attendance meanwhile releasing the fastenings of the door at the wagon end. The cradle is stopped close to the vessel's deck, and the outer ropes are then slacked off until the cant is sufficient to cause the coal to shoot. Eight of these tips are in use, each of which is capable of discharging 30 cars per hour.

At Grimsby (Manchester, Sheffield & Lincolnshire Ry.) there are four coal jetties with 15 spouts for the shipment of coal, and eight vessels can load at one time. At the newest jetty in the Royal Dock there are two outside lines for the loaded wagons to the spouts, and one central line for the return of empties. The switching engine places the car on the jetties, and a small engine is employed to place the cars over the spouts, which are laid between the rails. The cars are emptied through the bottom doors, or when not fitted with bottom doors, the end-doors are opened and one wagon is sufficiently raised by means of a hydraulic ram to cause its contents to fall into the shoots or spouts. The cars as they are emptied are placed on the central line, and work away by gravitation to a point where they can be dealt with by the ordinary switching engine.

At Swansea, coal from the Midland, Great Western and Rhondda & Swansea Bay railways, worked to the Prince of Wales Dock for shipment, is taken alongside the quays onto the hoists, which are raised by hydraulic power up to the spouts, over which the coal is tipped into the vessels. The cars as they are emptied run away from their elevated position onto a raised jetty by gravity. The spouts are supplied with a

* It must, of course, be remembered that English freight cars are small four-wheel cars, only some 18 ft. long.—Ed.

screening arrangement by which slack, which is not wanted, may be separated, and afterwards loaded into cars to be made into bricks of patent fuel at works near by. Each hoist is capable of unloading 30 cars per hour, and is provided with a crane attachment for the reloading of the cars, or for general crane work.

At Cardiff there is the largest export of coal, and the most recent system in operation at these docks was adopted in 1887, and consists of a hydraulic traveling crane (Lewis & Hunter's patent), a tip, and iron boxes capable of holding 10 tons of coal. The latter is received in a wall-sided pit, constructed close to and below the tip, which is on the level of the harbor. A car is turned on to the tip, which is lifted by hydraulic power, and the coal is emptied into the iron box. The latter is raised by the crane, and lowered into the ship's hold, when the conical-shaped bottom is loosed, and the contents of the box discharged and spread by the shape of the bottom. Owing to these cranes being movable upon special lines alongside the quays as many cranes can be fixed as there are hatches to be filled. Each crane is capable of dealing on an average with about 250 tons per hour.

Ships for the conveyance of coal are being so constructed as to largely avoid the need of trimming; the delay in loading under present circumstances at Cardiff and elsewhere being mostly due to the trimming, which reduces the number of cars dealt with below the capacity of the coal-loading appliances.

In all the modes adopted for shipping coal, cars are adapted to the methods applied; bottom doors for Tyne Docks and North Docks, Liverpool; end doors for the tips at Leith and Garston, and both bottom and end-doors at Grimsby. This applies also to cars for different inland districts, as to whether they should be constructed with bottom doors or only side doors, and high or low sides, to meet not only the varying character of the loading screens at the collieries, or the methods of unloading at the wharves, where the unloading is in some cases done direct by hand to the carts, in others the coal is stacked on the ground, or it is let through the bottom of the wagon by means of shoots from high to low levels.

Cars suitably constructed to convey timber, furniture vans, boilers, girders, bar-iron, sheet glass, traction-engines, slates, cattle and general goods are utilized for such traffic; whilst for dead meat, covered cars fitted with ventilators and refrigerators are employed. Such arrangements not only tend to encourage traffic, but to promote its safe conveyance and expeditious handling.

Metal brakeshoes to the wheels of all cars are largely superseding wooden shoes, being more effective and conducing to economy, more particularly where much used on heavy gradients. The cars are now usually fitted with one brake which is applied from the side.

The Lake St. Elevated Ry. in Chicago is to adopt electricity for operating its line, encouraged by the success of the electric motors on the Metropolitan Elevated. About 50 motor cars will be required for the road; the motors are to be furnished by the General Electric Co.

ELECTRIC LOCOMOTIVE; BALTIMORE & OHIO R. R.

An important event of the past week has been the putting into service of the first electric locomotive for hauling trains through the Baltimore Belt Tunnel, at Baltimore, Md., which is the new route by which the Baltimore & Ohio R. R. passes through that city, avoiding the old Canton ferry transfer. The tunnel has been fully described and illustrated in our columns, and the power house, electric locomotives and overhead equipment were described in our issue of Nov. 29, 1894, at which time we gave a view of one of the trucks of the engine. We publish this week a view of the first completed locomotive, ready for service.

The locomotive consists of two separate and independent motor trucks coupled together and surmounted by a central cab and shields encasing the apparatus. Each truck has four 62-in. driving wheels, with a wheel base of 6 ft. 10 ins., and each axle has a gearless motor mounted on a sleeve, to which are attached to cast steel spiders which engage with the driving wheels, rubber blocks being fitted on the ends of the arms of the spider. The wheels are of cast steel and the axles of open-hearth steel. The motors have each six poles and six sets of carbon brushes, and the ironclad series-wound drum armatures are keyed upon the hollow driving sleeves, the inside diameter of which is 2½ ins. greater than the diameter of the axle. The trucks have forged frames with welded pedestals, and have heavy timber bumper beams at each end, while the outer ends are fitted with Janney automatic couplers. The engine is 35 ft. long over all, 9 ft. 6¼ ins. wide, and weighs 192,000 lbs., all the weight being on the driving wheels and the drawbar pull being 42,000 lbs., or 60,000 lbs. at starting. The cab is of steel, with side doors, and drop windows in the sides and ends. The end casings or shields are also of steel and contain the compressed air reservoirs, compressors, etc., besides covering and protecting the truck motors and other mechanism. An electric air-compressor with oscillating cylinder supplies air for the Westinghouse brake, which is applied to the treads of all the driving wheels, and for the whistle. On top of the cab are two trolley carriers of diamond shape, composed of jointed bars, so that the height varies according to the position of the conductor, while the carriers can be inclined either way, the conductors being at the center of the tunnel and not over the center of each track. There will be three of these engines, all built by the General Electric Co. at its works, at Schenectady, N. Y. They resemble in general design the four-wheel switching locomotive exhibited by this company at the Columbian Exhibition, and illustrated in our issue of July 13, 1893.

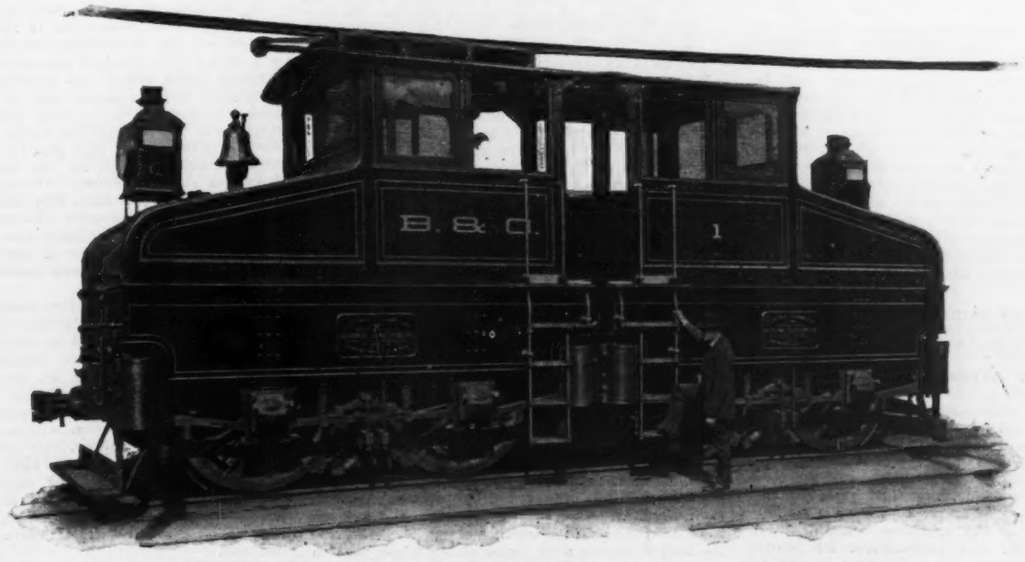
The locomotive made its first run through the tunnel on June 27, hauling a steam locomotive and running at a speed of about 20 miles per hour. On July 6 a train of 14 empty passenger coaches and a steam locomotive was hauled through the tunnel by the electric locomotive, and on July 8 it was attached to a train of 28 loaded coal cars and a steam locomotive and hauled it half way through the tunnel when part of the electrical connection between the locomotive and the overhead conductor gave way and the current collecting shoe was found to be red hot. The steam locomotive tried to pull the train ahead, but had to divide it into sections to haul it.

MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The twelfth general meeting of the Institute was held at the Cataract House, Niagara Falls, N. Y., June 25 to 28. At the opening session on June 25 the new President, Dr. Louis Duncan, took the chair, and an address of welcome was given by the mayor of Buffalo, N. Y. The first paper presented was on "Properties of Fuse Metals when Subjected to Short Circuits," by Mr. W. E. Harrington, in which it was claimed that fuse metals are not to be depended on, and this view was in the main sustained in the discussion. Two other papers presented at this meeting were "The Theory of the General Alternating Current Transformer," by Mr. C. P. Steinmetz, and "The Location of Grounds in Armatures, Fields, Etc," by Mr. C. E. Gifford. In the afternoon visits were made to the works of the Niagara Falls Power Co., the Pittsburg Reduction Co., the Carborundum Co., the Buffalo & Niagara Falls Light & Power Co., and the Niagara Falls Paper Co.

At the evening session the President, Dr. Duncan, read his inaugural address, taking as his subject "The Substitution of Electricity for Steam in Railway Practice," the conclusions arrived at being very conservative as to the future of electric traction, more especially for freight service, as steam railways are not ready to undertake such traction. An abstract of this address is given in another column. A paper on "Compounding Dynamos by Armature Reaction" was then read by Prof. Elihu Thomson.

On June 26 the first paper presented was on "Electric Power in Factories," by Prof. Crocker and Messrs. Benedict and Pope, showing the economy of such power over steam power, especially in the reduction of loss in transmission through shafting. Mr. C. P. Steinmetz then read a paper on "Some Features of Alternating Currents," and this was followed by a paper on "Some Observations on a Direct Connected 300-KW. Monocyclic Alternator," by Prof. Dugald C. Jackson and Mr. S. B. Fortenbaugh. In the afternoon a trip was made over the electric railway of the Niagara Falls Park & River Ry. Co., on the Canadian side of the river, and in the evening Mr. Chas. E. Emery read a paper on "The Cost of Steam Power," in which he stated that the Niagara Falls Power Co. proposes to sell undeveloped power at $10 per HP. per



ELECTRIC LOCOMOTIVE FOR THE BALTIMORE BELT RY.; The General Electric Co., Builders.

year, power at turbine shafts at $13, and at dynamo terminals at $18 per HP. per year. Even at these rates steam power can sometimes be developed in competition by the utilization of the heat of the exhaust steam.

On June 27 the following three papers were presented at the morning session: "The Cause of Death in Electric Shock," by Dr. A. M. Bielle; "Long Distance Power Transmission at 10,000 Volts," by Mr. G. H. Winslow, describing the plant at Pomona, Cal., for a transmission of about 20 miles; and "Alternating Current Curves," by Mr. Chas. E. Emery. In the evening Mr. F. L. Pope presented a paper on "Notes on the Reconstruction of a Small Station Plant," and an illustrated description of the great Niagara Falls water power scheme and plant was given by Dr. Coleman Sellers, and by Mr. L. B. Stillwell, the latter being the engineer of the Westinghouse Electric & Mfg. Co.

At the closing session on June 28 Mr. W. L. R. Emmett read a paper on "Existing Commercial Applications of Electrical Power from Niagara Falls," describing particularly the plant put in by the General Electric Co. for the Pittsburg Reduction Co.'s works. The meeting then adjourned.

BOOK REVIEWS.

HISTORY OF THE RENSSELAER POLYTECHNIC INSTITUTE, 1824-1894. By Palmer C. Ricketts. New York: John Wiley & Sons. 8vo; 193 pp.; illustrated; $3.

The many graduates of the Rensselaer Institute will welcome this work of Director Ricketts. The history commences with the foundation of the school and continues with an account of its organization and reorganization, and its present equipment, methods and curriculum. It closes with a list of the trustees and graduates from 1824 to 1894. The names of Stephen van Rensselaer and Amos Eaton are prominently identified in this history with the early growth and progress of this famous engineering school; and this volume recalls to the minds of the later students the memory of Mr. Eaton, to whom the development of this school was intrusted by its founder, and who, as senior professor for the first seventeen years of its existence, did so much to further and to guide this development.

AMERICAN STREET RAILWAY INVESTMENTS. A Supplement to the "Street Railway Journal." New York: Street Railway Publishing Co. Cloth; 4to; pp. 248; 25 maps; $3.

The first edition of this annual publication was reviewed in our issue of July 12, 1894, and the present volume is on the same plan, considerably extended. The various cities and towns are given in alphabetical order, with details of the financial and traffic conditions of the several street railways in each place, and particulars of the equipment and officers of the companies, and the population, municipal statistics and manufacturing industries of the towns. The statistical matter refers to 978 operating companies, 101 leased roads, and 387 new corporations, all located in 688 cities and towns. The year 1894 is said to have shown some improvement over 1893, and much larger gross earnings, with somewhat larger net earnings, are anticipated. A serious omission in this, as in the first edition, is that no general summary or table is given to show the vast extent and financial importance of the street railway systems of the country in the aggregate, or to show the development of electric traction or the averages of cost of operation, etc. We referred to this omission in our review of the first edition, and it is unfortunate that it has not been supplied in the new edition. Apart from this, the book is very complete, and contains much valuable statistical information.

REPORT OF THE CITY OF BALTIMORE TOPOGRAPHICAL SURVEY, to the Mayor and City Council of Baltimore, for the fiscal year ending Dec. 31, 1894. By Col. H. T. Douglas, Chief Engineer, Topographical Survey. Baltimore: 8vo; paper; 220 pp.; with maps.

This is a report well worth securing, for the information it contains as to the methods adopted and the results obtained in making a complete topographical survey of a large city. Col. Douglas and his able corps of assistants are to be congratulated upon the accuracy of their work. In base measurements a probable error of 1 in 985,334 is shown in a base line 6,897.3 ft. long; and in the final results of two runs over a base 7,500.6 ft. long, the probable error by comparison of each tape was 1 in 2,419,355; and by comparison of totals and mean, 1 in 15,000,000. A total of 282 miles of precise levels were run, in duplicating 141 miles of line, and 606 precise level benchmarks were established, on an average of 20 to the square mile. The computed probable error per 1,000 m. is usually taken as a standard for comparison in such work. On the Baltimore survey the probable error was 0.614 mm. per kilometer, or less than 1-50 in. per mile. In comparison with the results of similar work elsewhere, the record stands as follows:

	Probable error per kilometer, mm.
Coast survey: Sandy Hook to St. Louis, on Transcontinental line of precise levels	0.94 to 1.18
Coast survey: Mobile to St. Louis	0.74 to 1.25
Mississippi River Commission: Line from St. Paul to Savanna, Ill.	0.62
New Orleans to Gulf of Mexico	0.69
Baltimore survey	0.614

As seen above, the Baltimore levels compare most favorably with the best work done elsewhere, by the most precise of modern methods. The maps of the topographical survey of Baltimore embrace an area of about 32 square miles, and the primary triangulation covers 54.7 square miles, with an actual land area of about 30 square miles within the corporate limits. The report upon methods and results is very full and detailed, and it is a model document of its class.

THE UNITED STATES PUBLIC WORKS. Containing a summary of the methods of construction and character and materials and plant used in the public works under the charge of the War and Treasury Departments, and of the Commissioners of the District of Columbia, including works of river and harbor improvement, buildings at posts of the U. S. Army, lighthouses, public buildings, life-saving stations, and works of municipal engineering of Washington, D. C. Also of the laws, regulations and forms prescribed for the conduct of such works; a directory of the U. S. agents in charge of these works, and of contractors for them; also of manufacturers of and dealers in machinery, materials and miscellaneous supplies used in the construction of these works. Published as a book of reference for all persons interested in the public works, and for engineers and contractors in general. By Captain W. M. Black, of the Corps of Engineers of the U. S. Army, M. Am. Soc. C. E. New York: John Wiley & Sons. Oblong 4to; pp. 276; illustrated by 40 half-tone engravings and working drawings; $5.

While the lengthy title given above in some measure describes this work, its real usefulness to engineers and to contractors can only be fairly measured after a study of its contents. The general law and regulations of the various departments are, of course, most interesting to those doing business with these departments; but the convenient form in which they are here given will doubtless reveal many things not generally thought of even by the careful bidder. Under the more technical heads, those describing the methods of and appliances for doing public work, there is much valuable engineering detail. Costs are given very fully for special classes of work; the plant is described and the methods of work are explained. Dredging operations are gone into very fully, and various kinds of dredges are shown in minute detail. Some of the best dredges in use on government work are illustrated. Rock excavation under water and concrete construction are treated in like manner; jetties and dikes follow, both for sea, lake and river work; crib and pile foundations, river regulation, cofferdams of various types, canal-lock construction and dams, lighthouses and beacons, are all treated with a detail of actual cost, labor, material, etc., that would only be possible under the minute records preserved of the progress of government work. Another chapter relates to the business methods controlling the conduct of public works, and the book concludes with copies of the forms used in the various departments for all manner of business.

THE WATER SUPPLY OF TOWNS and the Construction of Water-Works. A Practical Treatise for the Use of Engineers and Students of Engineering. By W. K. Burton, Assoc. M. Inst. C. E.; Professor of Sanitary Engineering in the Imperial University, Tokyo, Japan; Consulting Engineer to the Tokyo Water-Works; Engineer to the Sanitary Bureau, Home Department, Japan. To Which is Appended a Paper on the Effects of Earthquakes on Water-Works, by Professor John Milne, F. R. S. London: Crosby Lockwood & Co. Philadelphia: J. B. Lippincott & Co. Large 8vo; pp. xiv., 304; 44 plates and 213 illustrations in the text; $9.

This book gives a good outline of the general principles of water-works design and construction, supplemented at many points by detailed information. While written more for the student than for the engineer, the latter will find some novel and useful suggestions and examples, in addition to which the book is a new presentation of an old and rapidly changing subject. The author, unfortunately, has not kept abreast of all the changes, especially on this side of the water. For instance: He regards the use of wood stave pipe, banded with iron, as perhaps a backward step; he is apparently unaware of many of our advances in the use of steel conduits, the development of meters and the meter system. The modern theory and practice of water purification by sand filtration seem to be unknown to Mr. Burton. He tells how filter beds are constructed, thinks they are something more than strainers and makes suggestions for their operation, but he is silent as to the German, English and American teachings regarding their efficiency as removers of bacteria. The reason for the author's failure here also accounts for his failure at other points: He has only partially availed himself of the information on recent ideas and practice, which is given week after week and month after month in engineering journals and the publications of technical societies. To ignore such storehouses of facts when preparing a treatise on live and changing topics is to miss one's greatest opportunity, which is to bring together and discuss the best from all possible sources, the labor of one man thus saving that of many.

The book is well bound and the typography and press-work are good, but there is a needless number of inset plates. Nearly all the illustrations presented on these plates might better have gone in the text, as they are on an unnecessarily large scale and poorly rendered at that. Text and figures in the text together now make up only some 300 pages, in addition to which there are 44 plates. Had the drawings for the plates been properly made, only 10 or 12 of these would have been necessary, and not more than 20 to 25 pages of combined text and illustrations need have been added. Some modifications of this sort would have improved the book in appearance and ease of handling, and diminished the excuses for putting so enormous a price upon it as $9.

THE NEW CROTON AQUEDUCT: Report to the Aqueduct Commissioners, by the President, James C. Duane, Containing Reports of the Secretary, Edward L. Allen, and of the Chief Engineer, Alphonse Fteley, Giving a Review of the Work of the Aqueduct Commission from Jan. 1, 1887, to Jan. 1, 1895, Including Plans and the Work of Construction of the New Croton Aqueduct, Proposed Dams and Reservoirs, and Appurtenances, Made in Accordance with Resolutions of the Aqueduct Commissioners. 4to; pp. 104; 14 tables; 50 photogravure inset plates, and 71 lithographic inset sheets of working drawings. Published by the Aqueduct Commisioners. Address the Secretary, Edward L. Allen, Stewart Building, New York, for copies, which are not on sale, and a limited number of which, only, are available for distribution.

To the close of 1894 the total expenditure for the work done under the direction of the Croton Aqueduct Commission was $29,257,000. Of this sum $2,700,000 was paid by the order of the court for property and property rights outside the jurisdiction of the Commissioners, and the greater part of the balance was paid for construction, including salaries and various incidentals. Under the certificates of the chief engineer, $19,760,000 has been paid for work on the new aqueduct and $3,384,000 for the construction of new reservoirs and accessories. The aqueduct has been practically completed since 1891, having been put in operation in 1890, but much dam and reservoir work remains to be done, including the major portion of the great storage reservoir on the Croton River, to be created by the immense masonry dam at the Cornell site.

The present report of the Aqueduct Commission covers seven years of its history, the first six years' work having been described in the first report, issued in 1887. During the period covered by this report work on the new aqueduct has been completed, and the storage reservoir construction has been taken up and considerably advanced. Seven dams, forming, or to form, four reservoirs, with a total capacity of nearly 60,000,000,000 gallons, have been put under construction, and three of them have been completed. The carrying capacity of the aqueduct, it may be stated here, is over 300,000,000 gallons a day, its length nearly 30 miles, and its size, through a great part of its course, equivalent to a circle 14 ft. in diameter.

After making the above statements, it is hardly necessary to remark that the present report, describing and illustrating work of such magnitude, will be a prize to those engineers who are so fortunate as to secure a copy. As intimated above, the edition is limited in number, and naturally great discretion must be exercised in distributing it. The publication of such a volume is very expensive, and it is to be hoped that the copies distributed may go to those who can make best use of them.

The reports of the president and secretary are largely historical, while that of the engineer is more in the nature of a description of the work, illustrated very fully with reproductions of photographic views and line drawings. Much information is presented in brief compass in tabular form, including the detailed bids for constructing the dams and reservoirs mentioned above.

Defective work on the aqueduct is described and illustrated in the engineer's report, and some valuable information is given regarding tests of the carrying capacity of the aqueduct, which proved to be some 5 or 6% below the original estimates.

The volume is a fitting companion to the handsome one issued as the first report of the Aqueduct Commission, and, as might be expected, is on the whole superior to that.

The very expensive photogravures with which the report is illustrated are reproduced from photographs taken on the work; and, while the reproduction is most excellent, the original photographs were in many cases only fairly good. It ought to be more generally understood by every one who has to do with the making of books that an engraving reproduced from a photograph can never be better than the original, and that to secure the best results, no pains should be spared to get the best and sharpest photographs.

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PERSONALS.

Mr. J. W. Morrison has been appointed Chief Surveyor for the Street Commission at Boston, Mass.

Mr. John Flynn, Jr., has been appointed Assistant Engineer to Mr. Schenk, City Engineer of Troy, N. Y.

Mr. Henry L. Brevoort, Mechanical Engineer, of Brooklyn, N. Y., died at Rockaway Beach, N. Y., July 5.

Mr. N. B. Montserrat has been appointed receiver of the Columbus, Sandusky & Hocking R. R., vice Mr. J. H. Stewart.

Mr. Willis L. Moore has been appointed Chief of the Weather Bureau of the Department of Agriculture, to succeed Prof. Harrington.

Mr. J. S. Wilbur has been appointed Division Engineer of the San Francisco & San Joaquin Valley Ry., with office at Stockton, Cal.

Lieut.-Col. Wm. R. King, U. S. Engineer Corps, has been put in charge of the improvements of the upper Mississippi River, with office at Rock Island, Ill.

Mr. Hiram Blood, formerly Manager of the Boston, Clinton & Fitchburg R. R., and President of the Cleveland & Canton R. R., died at Fitchburg, Mass., July 5.

Mr. Joseph B. Stearns, inventor of the Duplex system of telegraphy, and at one time President of the Franklin Telegraph Co., died at Camden, N. J., July 4, at the age of 65.

Mr. T. H. McKenzie, M. Am. Soc. C. E., of Southington, Conn., has been reappointed as the engineer member of the State Board of Health of Connecticut for a term of six years.

Mr. E. M. Byers, formerly a well-known iron manufacturer of Pittsburg, died at Kirkbride Asylum, Philadelphia, Pa., June 30. He was born at Greenfield, Pa., about 45 years ago.

Mr. A. G. Menocal, C. E., U. S. N., has been ordered to the Brooklyn Navy Yard to succeed Mr. P. C. Asserson, C. E., U. S. N., detached and ordered to the Norfolk Navy Yard.

Mr. C. A. Lichty and Mr. J. H. Howe have formed a partnership with the firm name of Lichty & Howe, to carry on a general practice in civil engineering, with headquarters at Madison, Wis.

Mr. W. H. Vorce has been appointed Superintendent of Signals on the Western Division of the New York Central R. R., to succeed Mr. P. C. Brewer, who has resigned on account of ill health.

Mr. C. L. Anderson, Auditor-General of the Norwegian State Railways, is visiting this country to make some inquiry into the systems of railway accounting and management practiced here.

Mr. Harrison Cary, Assistant City Engineer of Saginaw, Mich., died June 29. He was at one time City Surveyor, and had also been Chief Engineer of the Saginaw, Tuscola & Huron R. R.

Mr. Alfred H. DeCamp, a mechanical engineer in the employ of the Trenton Iron Co., was killed at Holyoke, Mass., by a plank falling off one of the towers of a cableway which he was erecting at that place.

Mr. J. K. Geddes, of Zanesville, O., has been appointed Receiver of the Bellaire, Zanesville & Cincinnati Ry. Co. Col. W. F. Hunter, of Columbus, O., has been appointed Counsel for the Receiver.

Mr. E. P. Storrs has been elected Superintendent of Water-Works at Hanover, N. H., and Mr. N. S. Huntington has been elected President of the water company to succeed Dr. Tucker, who has resigned.

Mr. Grant Wilkins, of Atlanta, Ga., has resigned his office as Chief of Construction of the Cotton States & International Exhibition, after having superintended the greater part of the erection of the main buildings.

Mr. Wm. Bailey Thomas has been appointed Division Superintendent of the Southern Ry., in charge of the division formed by the newly acquired Atlanta & Florida R. R., of which Mr. Thomas was Receiver and General Manager.

Mr. J. D. McIlwain, who has been appointed Superintendent of the Schoen Mfg. Co., of Pittsburg, Pa., was previously Superintendent of the Union Car Co., of Depew, N. Y., and the Harvey Steel Car & Repair Works, of Chicago, Ill.

Mr. William Brown, Chief Engineer of the Department of Public Safety at Pittsburg, Pa., has been appointed Superintendent of County Roads under the new road law passed by the last legislature. His salary will be $4,000 per year.

Mr. C. Stuart Patterson, of Philadelphia, Pa., has been elected a director of the Pennsylvania R. R. Co., succeeding the late Mr. H. H. Houston. He is a lawyer by profession, and has published works on laws relating to railway accidents.

Mr. R. R. Hammond has been appointed Division Superintendent in charge of the main line of the Kansas City, Fort Scott & Memphis R. R. between Springfield and Mile Post 481, and the Current River R. R., with headquarters at Springfield, Mo.

Mr. E. T. Haines, of Jamestown, N. Y., is now President and General Manager of the Jamestown & Lake Erie R. R., which is to be extended to Clifton, on Lake Chautauqua. Mr. W. E. Griggs, General Manager, and Mr. Frank S. Jones, Superintendent, have resigned.

Mr. Henry Wakefield Frye, Associate Editor of the "Electrical World," died at Folsom, N. Mex., June 20. He was born at Belfast, Me., in 1868, graduated at Colby University, Waterville, Me., and then studied electrical engineering at Johns Hopkins University, Baltimore, Md.

Mr. T. A. Miller has been appointed Assistant Superintendent of the Aurora Division of the Kansas City, Fort Scott & Memphis R. R., with headquarters at Aurora, Mo. This division was formerly the Greenfield & Northern R. R., and has been acquired by the K. C., Ft. S. & M. R. R.

Mrs. James B. Eads, widow of the celebrated bridge and canal builder, died at her residence in New York on July 5, aged 75 years. Mrs. Eads was the daughter of Dr. Hegaman, of Lawrenceburg, Ind., and was married to James B. Eads about 40 years ago. Five married daughters survive her.

Mr. Edward Manning Bigelow, M. Am. Soc. C. E., who has been Director of the Department of Public Works of Pittsburg, Pa., for seven years, has been honored by a statue erected by public subscription in acknowledgment of his work in securing to the people Schenley Park and Highland Park. Mr. Bigelow was formerly City Engineer of Pittsburg.

Mr. W. W. Gwathmey, Jr., has been appointed Chief Engineer of the Seaboard Air Line, with office at Portsmouth, Va. Mr. T. W. Whisnant has been appointed Superintendent of the First Division, with headquarters at Portsmouth, Va.; Mr. William Moncure, Superintendent of the Second Division, with headquarters at Raleigh, N. C.; and Mr. V. E. McBee, Superintendent of the Third Division, with headquarters at Atlanta, Ga.

Mr. W. W. Fugan has resigned his position as General Superintendent of the Kansas City, Fort Scott & Memphis R. R., and the office of General Superintendent is discontinued. Mr. J. H. Emmert has been appointed Superintendent, and will have charge of all transportation, also of the repairs and maintenance of buildings, and the repairs and maintenance of road, track and bridges, under the general direction of the Chief Engineer. The Superintendent's office will be in Kansas City, Mo.

Prof. Mark W. Harrington, Chief of the U. S. Weather Bureau, has been removed by the President, apparently owing to friction between himself and Secretary Morton, of the Department of Agriculture. Prof. Harrington was formerly a member of the faculty of the University of Michigan, and was appointed to his late office by Secretary Rusk in 1890, because of his long acquaintance with meteorological matters. The salary of Chief of the Weather Bureau is $4,500 per annum.

Mr. John P. Adams, ex-Commissioner of City Works in Brooklyn, died in that city on July 2. Mr. Adams was born near Newbury, Mass., on April 16, 1830; was educated at the Dummer Academy, and studied law with Caleb Cushing. He practiced law in Massachusetts before coming to Brooklyn in 1875. In 1885 he was chairman of the reorganized Democracy, and held that office until 1892. He was Commissioner of City Works through the terms of Mayor Chapin, and through that of Mayor Boody.

Mr. Chas. A. Allen, M. Am. Soc. C. E., of Worcester, Mass., has been retained by the city of Boston in connection with determining the price to be paid by the Metropolitan Water Board of Massachusetts for that part of the Boston water supply works which will be made a part of the new metropolitan system. Mr. Allen has also been engaged by the manufacturers in the Nashua and Merrimac valleys to serve as their engineer in the settlement for damages for the taking of the Nashua River as a supply for the above system.

Mr. Geo. F. Evans, Superintendent of the Southern Division of the Boston & Maine R. R., at Boston, Mass., has had his division extended to cover the Southern Division of the newly acquired Concord & Montreal R. R., as far as Concord, N. H. The Northern Division of the Concord & Montreal R. R. becomes the White Mountain Division of the Boston & Maine R. R., under Mr. Geo. E. Cummings as Superintendent, with office at Woodsville, N. H. The engineering office at Concord, N. H., is continued under Mr. F. A. Merrill, formerly Chief Engineer of the Concord & Montreal R. R.

Mr. John R. Freeman, M. Am. Soc. C. E., has been nominated by Gov. Greenhalge as member of the new Metropolitan Water Board of Massachusetts, to take the place of Mayor Whipple, of Brockton, whose nomination, reported in our issue of June 27, the council refused to confirm. Mr. Freeman graduated from the Massachusetts Institute of Technology in 1876. For a number of years he was principal assistant to Mr. Hiram F. Mills, Engineer for the Essex Co., which controls the water power of Lawrence, Mass. Nine years ago he became engineer to the Associated Factory Mutual Insurance Co.'s of Boston, and is now chief of the inspecting department of the companies. In addition to the above Mr. Freeman has performed a large amount of important work as a consulting engineer, in connection with water supply and water power systems.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ENGINEERING ASSOCIATION OF THE SOUTH.
July 11. Secy., H. D. Rahm, Nashville, Tenn.

MONTANA SOCIETY OF CIVIL ENGINEERS.
July 13. Secy., Forrest J. Smith, Denver Block, Helena, Mont.

ENGINEERS' CLUB OF MINNEAPOLIS.
July 15. Secy., E. Nelson, Kasota Block.

AMER. ASS'N FOR THE ADVANCEMENT OF SCIENCE.
Aug. 28 to Sept. 7. At Springfield, Mass. Secy., F. W. Putnam, Salem, Mass. Local Secy., Wm. A. Webster, Springfield, Mass.

NATIONAL IRRIGATION CONGRESS.
Sept. 16 to 19. At Albuquerque, N. Mex. Secy., Fred L. Allen, Los Angeles, Cal.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 11 to 13. At Burlington, Vt. Secy., John C. Whitney, Newton, Mass.

NEW ENGLAND ROADMASTERS' ASSOCIATION.
Sept. 18, 19. Secy., M. C. Hamilton, Hartford, Conn.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 8. At Atlanta, Ga. Secy., R. W. Raymond, New York, N. Y.

ROADMASTERS' ASSOCIATION OF AMERICA.
Oct. 8. At St. Louis, Mo. Secy., W. W. Sharpe, Waycross, Ga.

AMERICAN INT. ASSOC. OF RY. SUPTS. OF BRIDGES AND BUILDINGS.
Oct. 15. At New Orleans, La. Secy., S. F. Patterson, Concord & Montreal R. R.; Concord, N. H.

AMERICAN STREET RAILWAY ASSOCIATION.
Oct. 15. At Montreal, Que. Pres., Joel Hurt, Atlanta, Ga.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
July 12.	School building repairs,	Chicago, Ill.	June 27
July 12.	Paving,	Buffalo, N. Y.	June 27
July 12.	Macadamizing,	Springfield, Mass.	July 4
July 13.	Sewers,	Rochester, N. H.	July 4
	Advertised, Eng. News, July 4.		
July 13.	Sewer materials,	Rochester, N. H.	July 4
	Advertised, Eng. News, July 4.		
July 13.	Sewers (10,050 ft.),	Ithaca, N. Y.	July 4
	Advertised, Eng. News, July 4.		
July 13.	Court house addition,	East Cambridge.	July 4
July 13.	Grading,	Bellevue, Pa.	July 11
July 13.	Pipe sewers (11,200 ft.),	Rutland, Vt.	July 11
July 13.	Brick sewers (1,200 ft.),	Rutland, Vt.	July 11
July 13.	Bridges (2),	Westwood, N. J.	July 11
July 13.	Brick paving,	Cleveland, O.	July 11
July 13.	Asphalt paving,	Indianapolis, Ind.	July 11
July 13.	Paving,	Toronto, Ont.	July 11
July 15.	Brick pvg (13,165 sq. yds.),	Waukegan, Ill.	June 20
	Advertised, Eng. News, June 20 and 27.		
July 15.	Electric lighting,	Vicksburg, Miss.	June 20
July 15.	Sewers,	Swarthmore, Pa.	June 27
July 15.	Court house vaults,	Helena, Mont.	June 27
July 15.	Road (3 miles),	Missoula, Mont.	July 4
July 15.	Brick paving,	Montgomery, Ala.	July 4
July 15.	Water bonds ($200,000),	Waterbury	July 4
July 15.	Pipe sewers (18,000 ft.),	Roselle, N. J.	July 4
	Advertised, Eng. News, July 4 and 11.		
July 15.	Water-works system,	Franklin, Minn.	July 4
July 15.	Water-wks. system,	Hightstown, N. J.	July 4
	Advertised, Eng. News, July 4.		
July 15.	School house,	Baltimore, Md.	July 4
July 15.	Court house plans,	Huntington, W. Va.	July 4
July 15.	Cobblestone paving,	Brooklyn, N. Y.	July 4
July 15.	Paving brick (1,000,000),	Allegheny, Pa.	July 4
July 15.	Brick paving,	Cincinnati, O.	July 4
July 15.	Stone arches (2),	Syracuse, N. Y.	July 11
July 15.	Pipe sewers,	Syracuse, N. Y.	July 11
July 15.	Pipe sewers (3,140 ft.),	Boston, Mass.	July 11
July 15.	Pipe sewers,	Albany, N. Y.	July 11
July 15.	Granite block paving,	Albany, N. Y.	July 11
July 15.	Paving,	Jamestown, N. Y.	July 11
	Advertised, Eng. News, July 11.		

July 15.	Paving, Newburg, N. Y.	July 11	
July 15.	Paving, Walden, N. Y.	July 11	
July 15.	Sewers, Allegheny, Pa.	July 11	
July 15.	Street improvements, Philadelphia, Pa.	July 11	
July 15.	Brick paving, Cincinnati, O.	July 11	
July 15.	Water-wks. extensions, Galesburg, Ill.	July 11	
July 15.	Sewer, Denver, Colo.	July 11	
July 15.	Bridges (7), Pawnee City, Neb.	July 11	
July 15.	Wagon road, Portland, Ore.	July 11	
July 16.	Court house, etc., Houston, Tex.	June 27	
July 16.	Macadamizing (50 m.), Morristown, N. J. Advertised, Eng. News, June 27 to July 11.	June 27	
July 16.	Boiler for water-works, Dallas, Tex.	July 4	
July 16.	Sewers (11,400 ft.), Wilmington, Del. Advertised, Eng. News, July 4 and 11.	July 4	
July 16.	Pig lead, Columbus, O.	July 11	
July 16.	Asphalt paving, New Bedford, Mass. Advertised, Eng. News, July 11.	July 11	
July 16.	Asphalt paving, Brooklyn, N. Y.	July 11	
July 16.	Stone paving, Jersey City, N. J.	July 11	
July 16.	Asphalt paving, etc., Jersey City, N. J.	July 11	
July 16.	Sewers (2,500 ft.), Jersey City, N. J.	July 11	
July 16.	Jail, Pulaski, Va.	July 11	
July 16.	Pipe sewers, Brazil, Ind.	July 11	
July 16.	Asphalt paving, Indianapolis, Ind.	July 11	
July 16.	Brick paving (5,000 lin. ft.), Marion, Ind.	July 11	
July 16.	Pipe (1,300 tons), Chicago, Ill.	July 11	
July 16.	Water-works system, Kasson, Minn.	July 11	
July 16.	School building, etc., Toronto, Ont.	July 11	
July 17.	Dredging and removing ledge, Newport.	June 20	
July 17.	Improvements, League Is. Navy Yard.	July 4	
July 17.	Steam fire engines (4), New York.	July 4	
July 17.	Macadam, etc., New York, N. Y.	July 11	
July 18.	Macadamizing, Elizabeth, N. J.	July 4	
July 18.	Sewers, etc., New York, N. Y.	July 11	
July 18.	Iron draw bridge, Hammonton, N. J.	July 11	
July 18.	Sewer brick, Washington, D. C. Advertised, Eng. News, July 11.	July 11	
July 18.	Asphalt paving, Indianapolis, Ind.	July 11	
July 18.	Water-wks. system, Maple Park, Ill.	July 11	
July 19.	Water and light bonds, Windom, Minn.	June 27	
July 19.	Flagging, etc., Elizabeth, N. J.	July 4	
July 19.	Street lighting, Marcus Hook, Pa.	July 4	
July 19.	School building, Mariette, Mich.	July 4	
July 19.	Parkway, Boston, Mass.	July 11	
July 19.	Sewers, Brooklyn, N. Y.	July 11	
July 19.	Street cleaning and sprinkling, Buffalo.	July 11	
July 19.	Sewers, Camden, N. J.	July 11	
July 19.	School building, Kingston, Pa.	July 11	
July 19.	Bridges (8), Wayne, Neb.	July 11	
July 19.	Jail, Hamilton, Ont.	July 11	
July 20.	Water-works franchise, Perth, Ont.	June 20	
July 20.	School buildings (2), Cleveland, O.	June 27	
July 20.	Water-works system, Union, Mo.	June 27	
July 20.	Water bonds, New Britain, Conn.	July 11	
July 20.	Intake tunnel, Buffalo, N. Y.	July 11	
July 20.	Building work, Geneseo, N. Y.	July 11	
July 20.	Asphalt paving, Saginaw, Mich.	July 11	
July 20.	Brick paving, Saginaw, Mich.	July 11	
July 20.	Brick paving, East St. Louis, Ill.	July 11	
July 22.	Electric light plant, Washington, D. C.	July 4	
July 22.	Bridge work, Salem, Mass.	July 11	
July 22.	Granolithic pavement, Baltimore, Md.	July 11	
July 22.	Brick sewer, South Bend, Ind.	July 11	
July 23.	Water-wks. system, Cape Vincent, N. Y.	July 4	
July 23.	Cleaning water basin, Waterbury, Conn.	July 11	
July 23.	Flagging, Brooklyn, N. Y.	July 11	
July 23.	Pipe sewers, Buffalo, N. Y.	July 11	
July 23.	Stone and pier work, New York.	July 11	
July 23.	Bridge substructure, Defiance, O.	July 11	
July 24.	Suspension cableway, Washington, D. C. Advertised, Eng. News, July 4 and 11.	July 4	
July 24.	Bridge pier, Providence, R. I.	July 11	
July 24.	Pipe sewers (7,850 ft.), Urbana, Ill. Advertised, Eng. News, July 11.	July 11	
July 25.	Electric light plant, Bellefontaine, O.	June 20	
July 25.	Brick paving, Lorain, O. Advertised, Eng. News, July 4 to 18.	July 4	
July 25.	Lighthouse metalwork, New Orleans, La. Advertised, Eng. News, July 4 and 11.	July 4	
July 25.	Water-wks. system, Warsaw, N. Y.	July 4	
July 25.	Lighthouse, New Orleans, La. Advertised, Eng. News, July 4 and 11.	July 4	
July 25.	Amusement hall, Washington, D. C.	July 11	
July 25.	Sewer, Lawrence, Mass.	July 11	
July 25.	Castings, Springfield, Mass., Armory.	July 11	
July 25.	Water-works system, Warsaw, N. Y. Advertised, Eng. News, July 11 and 18.	July 11	
July 25.	Iron bridges, Elkton, Md.	July 11	
July 26.	Water-works system, Monticello, Ind. Advertised, Eng. News, July 11 and 18.	July 11	
July 26.	Post office building, Richmond, Que.	July 11	
July 29.	Water-wks. system, Momence, Ill. Advertised, Eng. News, July 4 to 25.	July 4	
July 29.	Cement (625 bbls.), Cincinnati, O.	July 4	
July 29.	Sewers, Huntington, Ind.	July 11	
July 29.	Artesian well, Cambridge, Ill.	July 11	
July 30.	Court house plans, Atchison, Kan.	July 4	
July 30.	Library building plans, Hoboken, N. J.	July 11	
July 30.	Underground conduits, Cincinnati, O.	July 11	
July 30.	Court house plans, Knoxville, Ia.	July 11	
July 31.	Artesian well, Alvarado, Tex.	July 4	
July 31.	Electric light equipment, St. Clair, Pa.	July 11	
Aug. 1.	Water-wks. system, Logan, O. Advertised, Eng. News, July 4 and 11.	July 4	
Aug. 1.	Water-wks. franchise, West Rutland, Vt. Advertised, Eng. News, July 11 and 18.	July 11	
Aug. 1.	Armory at Camden, N. J.	July 11	
Aug. 1.	Granite block paving, Mobile, Ala. Advertised, Eng. News, July 11 to 25.	July 11	
Aug. 1.	Steel bridge, Ironton, O.	July 11	
Aug. 2.	Electric lighting, El Paso, Tex.	May 23	
Aug. 5.	Levee wk. (700,000 cu. yds.), Rock Island. Advertised, Eng. News, July 11 to Aug. 1.	July 11	
Aug. 6.	Court house, Dublin, Ga.	June 20	
Aug. 12.	Building addition, Los Angeles, Cal.	June 27	
Aug. 12.	Bridge, Rock Island, Ill.	July 11	
Aug. 20.	Capitol building, Olympia, Wash.	June 20	
Aug. 30.	Timber (60 sq. miles), Ottawa, Ont.	July 11	
Sept. 5.	State capitol plans, St. Paul, Minn.	July 11	
Sept. 18.	Water-wks. franchise, Butte, Mont. Advertised, Eng. News, July 11 to Aug. 8.	July 11	
Oct. "	Plans for art building, Philadelphia, Pa. Advertised, Eng. News, May 23 to June 27	May 23	
No date.	Building plans, London, Ont.	July 11	
" "	Railway (25 miles), Raleigh, N. C.	July 11	
" "	Canal excavation Portland, Ore.	July 11	

RAILWAYS.

East of Chicago.

LONG LAKE.—Incorporated in New York July 3 to construct a steam road in the Adirondacks about 10 miles in length, from Axton to Long Lake, connecting at Axton with the Raquette Lake R. R., running from Axton to Raquette Lake; capital stock, $100,000; directors, C. E. Arnold, A. J. Voyer, W. P. Shaw, M. J. Canady, John Wagner and Clifford D. Gregory, of Albany; F. K. Johnson, of Bath; George I. Humphrey, of Saratoga, and Fred S. Wadhams, of New York. C. E. Arnold holds 700 and A. J. Voyer 287 of the 1,000 shares. Mr. Arnold is the chief projector of the Raquette Lake road, as noted last week. The state railroad commission will give a hearing on July 16 on the company's application for permission to construct its road.

MILLERSBURG, ASHLAND & GREENWICH.—Press reports state that H. B. Camp, Pres., Akron, O., has signed an agreement to have this railway completed to Jeromeville, O., by Sept. 16. The road is projected to connect Greenwich, Ashland, Jeromeville and Shreve, and about eight miles were completed several months ago. Ch. Engr., John H. Hall, Canton, O.

SEBASTICOOK & MOOSEHEAD.—The town of Harmony, Me., has voted, 117 to 2, to aid the proposed extension of this railway to the extent of the town's debt limit. It is expected that the construction will be commenced this month. Pres., Z. D. Lancaster, Fredericton, N. B.

WELLSTON & JACKSON BELT.—The contract for grading and bridging this road, 20 miles in length, was awarded July 2 to John M. Lahy, of Detroit, Mich. The new road will tap valuable coal fields. Frederick S. Sheldon, of Columbus, O., Ch. Engr. Columbus, Hocking Valley & Toledo, is chief engineer. The headquarters of the contractor will be at Wellston, O.

WISCONSIN & MICHIGAN.—Press reports from Marinette, Wis., state that this company will soon begin work on an extension from Faithorn Junction, Mich., northwest to Florence, Wis., about 25 miles, to tap the principal mines of the Menominee iron range. Gen. Man., J. Bagley, Menominee, Mich.

Southern.

CHATTAHOOCHEE VALLEY.—Reports from West Point, Ga., state that surveys are being made for the early construction of this railway between that city and Langdale, Ala., and that M. L. Lanier, Pres., has returned from the East, where he secured capital to build the road.

COLUMBUS, HUNTINGTON & GUYANDOTTE.—Cabell and Wyoming counties, W. Va., have voted to issue $100,000 in bonds to aid in the construction of this railway from Huntington up the Guyandotte valley.

GEORGIA & TENNESSEE.—Incorporated in Georgia July 2 to build a railway from Atlanta, Ga., to some point on the Tennessee state line in Catoosa county; capital stock, $2,000,000; incorporators, Thos. M. Barna, A. H. Benning, R. B. Bullock, James A. Gilbert, P. G. Grant, Daniel B. Harris, John S. Pinchan, James L. Riley, Roby Robinson, R. F. Shedden, and others.

KENTUCKY SOUTHERN.—The Kentucky Southern Ry. Co., with a capital of $250,000, and the Southern Construction Co., with a capital of $25,000, were incorporated in Kentucky June 28. Both are composed of the same stockholders: G. Lionel Prescott, London, Eng.; W. S. Manning, Wisconsin; L. F. Hobble, W. H. Kinnaird, R. L. Hubble and J. D. Smith, Lancaster, Ky. The purpose of the Kentucy Southern Ry. Co. is to construct a railway from the mouth of Little Rockcastle River down to Big Rockcastle River, along the line of Laurel, Rockcastle and Pulaski counties, a distance of 35 miles to the Cumberland River. The highest amount of indebtedness the company can assume is $40,000. The Southern Construction Co. is organized to construct and equip the road.

RALEIGH, N. C.—Bids are asked, according to reports in another paper, for constructing a standard gage railway 25 miles long, the line to be laid with 60 to 70-lb. steel rails on hard wood ties, and ballasted with gravel or sand. Also necessary masonry work for culverts and several bridges. Telegraph poles for entire route with wiring will be used, and six to eight frame station houses with wooden or slate roofs and oil and pine finish; also standard gage locomotives, passenger, flat and freight cars. Address J. D. Boushall.

Northwest.

CHICAGO, MILWAUKEE & ST. PAUL.—This company is reported about to make extensive improvements in its roadbed. The work will require a large number of new ties and steel rails, according to reports. Ch. Engr., D. J. Whittemore, Chicago.

GLADSTONE, WHITEFISH & SUPERIOR.—The contract for grading the first five miles of this new road, from Gladstone, Mich., has been awarded to W. J. Merston & Co., of Minneapolis, Minn. This road, which is projected by the Cleveland Cliffs Iron Co., will open up an immense tract of hardwood timber, and is intended eventually to reach the Marquette mining district. Gen. Man., Austin Farrell; Ch. Engr., E. C. Brown.

GREAT NORTHERN.—It is stated at St. Cloud, Minn., that Foley Bros. & Guthrie, of that city and St. Paul, have been awarded the contract for building a branch line for this road from Casselton to Hope, N. Dak., a distance of 8 or 10 miles. The construction will be commenced at once.

MINNEAPOLIS, ST. PAUL & ASHLAND.—Press reports state that Ashland county, Wis., has voted to issue $125,000 in bonds to aid in the construction of this road on condition that the road be completed from Ashland, Wis., to St. Paul and Minneapolis within a year. It is stated that construction will begin at once.

Southwest.

GULF & INTERSTATE.—L. P. Featherstone, Secy., Galveston, Tex., writes us as follows: We have no connection whatever with the Kansas company now in the hands of the receiver, nor do we know of any work that the Kansas company has done at any point along the line contemplated by it. As for our road, we have 70 miles graded, 7 miles of track laid and the contract let to finish up the entire line within 120 days. This means the completion of the line between Bolivar Point, just across the bay from Galveston and Beaumont, the terminus of the Beaumont, Kansas City & Gulf road and a great lumber depot for eastern Texas.

KANSAS CITY, FORT SMITH & MEMPHIS.—Press reports state that this railway is to be completed into Miami, Ind. Ter., by Jan. 1, 1896, according to an agreement recently made with the officials of the company. The road is to be extended from Baxter Springs, Kan., to Miami, 14 miles. By the terms of the agreement, the town of Miami is to raise $11,000 and furnish right of way into the limits of the town and an acceptable depot site.—This company has acquired the Greenfield & Northern, and will operate it as its Aurora division.

TIMBER BELT & COMMERCIAL.—Incorporated at Little Rock, Ark., according to press reports, to build a railway from El Dorado, Union county, in an easterly and southeasterly direction to a point on the Louisiana and Arkansas state line, about 35 miles; capital stock, $300,000. Pres., Jesse B. Moore; Vice-Pres., Jas. Marsh; Secy., Jas. Puryear; Treas., B. W. Reeves.

Rocky Mt. and Pacific.

SAN FRANCISCO & SAN JOAQUIN VALLEY.—This railway has been located for 25 miles south from Stockton, Cal., and rights of way practically secured for that distance. Preliminary surveys are being made farther south. The line is projected from San Francisco to Bakersfield, Cal., via Stockton, 350 miles, and one-half of the capital stock has been subscribed. The contracts for the construction have not yet been awarded, though local papers state that bids will soon be received for the work. Ch. Engr., W. B. Storey, Jr.; Pres., Claus Spreckles; principal office, 321 Market St., San Francisco.

STREET AND ELECTRIC RAILWAYS.

MILLBURY, MASS.—The Blackstone Valley Electric Ry. Co. has been organized to build an electric railway from this place to Northbridge. It is reported that about $20,000 has been subscribed towards the $100,000 required to build the railway. F. A. Lapham, of Worcester; Samuel E. Hull, H. A. Ryan and James H. Ferguson, of Millbury, and E. E. Howe, of Fisherville, are interested.

ALBANY, N. Y.—The Albany & Suburban Ry. Co. has been incorporated to build an electric railway to connect Greenbush, Castleton and Bath-on-the-Hudson with Albany, a distance of 12 miles; capital stock, $200,000; directors, F. R. Barnes and Geo. T. Cunningham, of Ballston; Geo. D. Moore, of Worcester, Mass.; Arthur Hilton, of Boston, Mass.; Albert J. Barnes, of Troy, and Chas. A. Goddard, of Lowell, Mass.

GREENWICH, N. Y.—The Greenwich & Schuylerville Electric R. R. Co. has been incorporated to build a road six miles long; capital stock, $200,000; directors, Watson N. Sprague, of Greenwich; Martin Schenck and Reeves Smith, of Troy; James Mealey and James E. Kelly, of Schuylerville; Thos. W. Cantwell, of Albany, and Alben M. Crandall, of Middle Falls.

JAMAICA, N. Y.—It is reported that Col. A. A. Degraw, of Jamaica, is interested in a projected double-track electric railway from Jamaica to Hempstead.

NIAGARA FALLS, N. Y.—It is reported that the contract for the two-mile connecting link between the Niagara Falls street railway system and the Buffalo & Niagara Falls Electric R. R. has been awarded to Hardwicke & Jones, of Niagara Falls, at about $20,000. The work is to be completed in 35 days.

TRENTON, N. J.—The Trenton Passenger Ry. Co. has petitioned for permission to extend its electric railway. Ch. Engr., J. Hyde, Jr.

BEAVER FALLS, PA.—The Patterson Heights St. Ry. Co. has been incorporated to build an electric railway between Beaver Falls and Patterson Heights; capital stock, $6,000; Pres., John Reeves, of Beaver Falls.

FOREST CITY, PA.—The Carbondale & Forest City Passenger Ry. Co. has been granted a franchise for its electric road. Gen. Man., J. W. Aitken, of Carbondale.

KANE, PA.—The Kane St. Ry. Co. has been incorporated to build an electric railway; capital stock, $6,000; Pres., F. A. Lyte.

PHILADELPHIA, PA.—It is reported that estimates are being asked for the erection of a power and engine house at Overbrook for the People's Traction Co.

PHILADELPHIA, PA.—The Grand Boulevard St. Ry. Co. has been incorporated to build an electric railway from Pulaski Ave., in the 23d ward, to Fishers Lane; capital stock, $50,000; Pres., O. M. Thomson, 1942 North 17th St.

PITTSBURG, PA.—The Pittsburg, Sheraden & Carnegie Traction Co. has been incorporated to build an electric road from Esplen borough, Allegheny county, to Sheraden, Crafton and Carnegie, a distance of seven miles; capital stock, $42,000; Pres., Harding Kimberland, of Sheradenville; directors, H. J. Wenke and Miller Elliott, of Pittsburg, and D. H. Ferrell, of Sheradenville.—The Little Saw Mill Run St. Ry. Co. has been incorporated to build an electric railway from Woodville Ave. to Castle Shannon; capital stock, $36,000; Pres., M. P. Howley, of Pittsburg.—Our correspondent writes us that the Ft. Pitt Traction Co. contemplates building a new road to the east, parallel with the Pennsylvania R. R., at an estimated cost of $800,000; Pres., Joshua Rhodes. Senator William Flinn, Pres. Ft. Pitt Incline Plane Ry. Co., is interested.

BALTIMORE, MD.—There is talk of organizing a company to build an electric railway from this city to Wetheredsville by way of Franklin and Windsor Mills. John Hubner, of the Baltimore, Catonsville & Ellicott Mills Ry. Co., and J. H. Judik, Pres. People's National Bank, are interested.

WASHINGTON, D. C.—Samuel R. Adams, of Camden, S. C., has been awarded the contract for constructing the Washington & Great Falls Electric Ry. It is stated that the work will be begun at once north of the Foxhall road, on the Chesapeak & Ohio Canal Co.'s property.

NORFOLK, VA.—The supervisors of Norfolk county have granted the Portsmouth St. Ry. Co. permission to extend its electric railway on certain roads. John A. Codd, Wm. S. Johnson and E. M. Tilley compose the committee.

BOWLING GREEN, KY.—It is reported that J. A. Gaboury, of Atlanta, Ga., has been awarded the contract for constructing the electric railway. The bids were received June 29, as stated in our issue of June 27.

KINSMAN, O.—The North Trumbull Rapid Transit Co. has been incorporated with a capital stock of $10,000.

NEW ALBANY, IND.—It is reported that the New Albany Highland R. R. Co. will probably be reor-

ganized and its electric road extended. Gen. Man., G. P. Hartrich.

CHICAGO, ILL.—The following companies have recently been incorporated: Western Compressed Air Traction & Construction Co.; capital stock, $500,000; incorporators, Ralph R. Bradley, Wm. M. Fletcher and Frank F. Pratt. Chicago Western Electric St. Ry. Co.; capital stock, $5,000,000. Metropolitan Traction Co.; capital stock, $10,000,000; incorporators, Fred Laas, 701 North Rockwell St.; Henry F. Keene, and William Grotto.——Press reports state that S. R. Ainslie, Gen. Man. Chicago & Northern Pacific R. R. Co., has decided to equip the Chicago Suburban trains of that road with electricity.——It is reported that the Lake St. Elevated Ry. Co. has awarded the contract for equipping 35 of its cars as motor cars, etc., to the General Electric Co. The power will be furnished by the West Chicago St. Ry. Co. The change of motive power will cost the company about $200,000. ——The Chicago City Ry. Co. is considering the question of extending its electric road on Clark St. Ch. Engr., C. C. Smith.

FREEPORT, ILL.—The South Freeport & Cedarville Electric Ry. Co. has been incorporated to build a road 10 miles long; capital stock, $100,000; incorporators, A. Bergman, Henry Lichtenberger and A. Baumgartner.

OTTAWA, ILL.—The Ottawa Electric St. Ry. Co. is considering the question of extending its road on several streets in order to form a loop.——The Hinlonburgh council has granted the company a 20-year franchise over the Richmond Road. Gen. Man., H. A. Kin.

SOUTH MILWAUKEE, WIS.—F. W. Rogers and E. M. Spalding have applied for a franchise for an electric railway.

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Electric Co. has been incorporated to build a street railway; capital stock, $200,000, with $50,000 paid in; incorporators, S. J. Keese, of Los Angeles; J. V. McMullan, of New York, N. Y.; A. Hope Doeg, B. S. Hayne, C. C. Newman and W. F. Reed, of Santa Barbara, and P. C. Higgins, of Carpinteria.

NIAGARA FALLS, ONT.—The Niagara Falls Electric St. Ry. Co. has been incorporated with a capital stock of $125,000 by Alexander Manning, Hume Blake, Z. A. Laish and P. A. Manning, of Toronto, and Charles Black, of Welland.

ELECTRIC LIGHT AND POWER.

MANCHESTER, N. H.—The Union Electric Co. of this city is considering the construction of a large dam and electric power station on the Piscataquog River, at Goffstown. The dam will be over 600 ft. long, about 45 ft. high at the highest place, and will give 50 ft. fall and 2,000 HP. Four horizontal water wheels will be used. The dam will be built of granite taken from near the site. Engrs., Bartlett & Gay, of Manchester.

MELROSE, MASS.—The question of constructing an electric light plant at an estimated cost of $50,000 is being considered.

NORTH ADAMS, MASS.—It is reported that the Adams Power Co. has purchased the power plant at Zylonite, which has been idle for some time, and that it is proposed to build a dam at once at that place. Pres., Charles Howland; Vice-Pres., H. H. Wellington. L. L. Brown is interested.

ST. CLAIR, PA.—The citizens have voted to issue $9,000 in bonds for extending the electric light plant.

ST. CLAIR, PA.—Bids are asked by the committee until July 31 for furnishing two incandescent dynamos of 1,100 16 c. p. each, with station equipments, and for one 250 HP. engine. Supt., Julius Schlump.

SEWICKLEY, PA.—The council is considering the question of building a municipal electric light plant at an estimated cost of $10,500.

CHAPEL HILL, N. C.—At a recent meeting of the executive committee of the University of North Carolina, it was decided to put in an electric light plant for use in university buildings and grounds at once, to cost $7,000. A committee, consisting of Prof. Wallace Riddick, Chn., Dr. R. H. Lewis and R. T. Gray, of Raleigh, was appointed to award the contract. The system must be in operation by September. Bids for furnishing and erecting one 80-HP. return tubular boiler and two 35-HP. high speed engines are asked until July 12 or 13. Address W. C. Riddick, Chn. Com., Raleigh, N. C.

GEORGETOWN, S. C.—W. E. Sudlow, of Florence, has been granted a franchise for an electric light plant, work on which will begin at once.

HAWKINSVILLE, GA.—An election is to be held July 17 to vote on the question of putting in electric lights. J. P. McGriff. Cy. Clk.

ABERDEEN, MISS.—The citizens have petitioned the council to make a contract for re-establishing the electric light plant, which has been idle for about a year.

MADISONVILLE, KY.—It is reported that this place wants bids for furnishing 30 arc lights. Address I. Bailey, Gen. Man. Reinecke Coal Co.

ATHENS, O.—The following bids were received, according to reports, for constructing an electric light plant: Elliott-Lincoln, $10,981; Jas. Brown & Son, Pittsburg, $11,563; $11,763. Fort Wayne Electric Co., Fort, Wayne, Ind., $11,500; $11,800; $11,300. Franklin Electric Co., Kansas City, Mo., $11,395 (awarded contract). Western Electric Co., Chicago, $11,370; $10,995. Alex. Schulman, Cincinnati, O., $11,009; $11,658; $11,275. Toft & Dole, Columbus, O., $11,418; $11,222; $11,572. Standard Electric Co. $11,512. Triumph Electric Co., $11,395; $11,746. Card Electric Co., $11,470; $10,850.

MUSKEGON, MICH.—Press reports state that a dam is to be constructed across the Muskegon River at its influx into Muskegon Lake, at a cost of $1,000,000. Two years will be required to build it. The river will be dammed up to Maple Island, and the area covered will be 15 square miles. The power can be supplied at one-third the present cost, or $20 per HP. a year. The dam will be 1½ miles in length and 22 ft. above water level. John Torrent and Herman O. Lange are interested.

WORTHINGTON, MINN.—It is reported that the citizens have voted to issue $15,000 in bonds for an electric light plant.

MADRID, IA.—S. A. Bongston, Cy. Recdr., writes us that J. P. Anderson & Co., of Madrid, have been granted franchises for electric lights and water-works.

HASTINGS, NEB.—The council is considering the question of granting a franchise to a new electric light company.

BOLIVAR, MO.—The citizens have voted to issue $8,000 in bonds for building an electric light plant and extending the water-works.

SPOKANE, WASH.—The Consumers' Light & Power Co. has petitioned for a franchise.

NEW COMPANIES.—Oregon Electric Light & Power Co., Oregon, Ill.; $50,000; Albert H. Knoble, Wm. L. Taylor and Lee Allen.

Laird Electric Power & Transportation Co., Des Moines, Ia.; $110,000; Robt. H. Laird, New York, N. Y.

Electric Wire Hanging Insulation Co., Chicago, Ill.; $200,000; Edgar O. Baker, Wm. A. Robertson, Henry W. Rice.

Cycle Electric Light Co., Chicago, Ill.; $100,000; to manufacture electrical appliances; W. A. Crowdus, John Zimmerman, John D. Thompson.

Elliott Magnetic Electric Co., Chicago, Ill.; $1,000,000; to manufacture magnetic and electrical appliances; Wm. R. Elliott, Isaac C. Robbins, Chas. A. Emmons.

Hall Construction Co., Des Moines, Ia.; $10,000,000; to build electric and gas light plants, etc.; Pres., Thurston G. Hall; Vice-Pres., Robt. H. Laird; Treas. and Secy., Loftus C. Downey, all of New York, N. Y.

Welsbach Commercial Co., New York, N. Y.; $7,000,000; to manufacture electrical appliances; Stanley H. G. Stewart, Emerson McMillan, Jr., Walstein F. Douthirt, E. F. Eldridge, J. C. Havermeyer, John H. Scoville, John L. Nisbet, of New York.

Santa Barbara Consolidated Electric Co., Santa Barbara, Cal.; $200,000, with $50,000 paid in; A. Hope Doeg, Santa Barbara; S. J. Keese, Los Angeles; N. F. Ashton, B. S. Hayne, of Santa Barbara; P. C. Higgins, of Carpinteria, Cal.; J. D. McMullan, New York, N. Y.

BRIDGES.

SALEM, MASS.—Bids are asked by the county commissioners until July 22 for rebuilding the abutment and wing walls of the Rocks Bridge, on the West Newbury side of the Merrimac River. Engr., Chas. A. Putnam, 251 Essex St., Salem; Edward B. Bishop, Comr.

ALBANY, N. Y.—The following bids were received for constructing the Northern Boulevard viaduct: Hilton Bridge Co., of Albany, $56,748; Boston Bridge Works, $61,717; Wrought Iron Bridge Co., of Canton, O., $62,471; Detroit Bridge Works, bid declared informal, also submitted design for a stone arch to cost $58,000.

MAMARONECK, N. Y.—J. A. Kirby, of Portchester, informs us that the following bids were received July 8 by the highway commissioners for a stone arch bridge over the Mamaroneck River between Rye and this place:

Dean & Westbrook, New York	*$13,475
Frank W. Molloy, New Rochelle, N. Y.	13,792
Murray & Molloy, Portchester, N. Y.	14,194
Wm. F. McCabe, Mamaroneck, N. Y.	14,845
Clark & Co., Brooklyn, N. Y.	16,974
John O. Merritt, Portchester, N. Y.	17,600
Woolfolk & Sillery, Mt. Vernon, N. Y.	22,497

*Awarded contract; work to be completed in 90 days.

NIAGARA FALLS, N. Y.—It is reported that the Niagara Falls & Clifton Suspension Bridge Co. has decided to advertise for bids for the mason work on the proposed bridge over the Niagara River. The bridge must accommodate the present carriage and pedestrian traffic and the trolley cars. The span at this point is more than 800 ft. long.——The council is making arrangements for the construction of a new bridge over Gill Creek, at Buffalo Ave., at an estimated cost of $4,500.

NEW YORK, N. Y.—It is reported that the board of estimate and apportionment has authorized an issue of $200,000 in bonds for the improvement of Riverside Park, $201,000 for the Jerome Ave. approach to the new Macomb's Dam bridge, $600,000 for the Washington Bridge Park, and $200,000 for the improvement of Park Ave. above 106th St.

ROCHESTER, N. Y.—The council proposes to widen the bridge over the railway at Clarissa St., at an estimated cost of $10,000.

HAMMONTON, N. J.—Bids are asked by the joint committees of the counties of Atlantic and Burlington until July 18 for constructing an iron draw in the bridge over Little Egg Harbor River at Green Bank. W. T. Sooy, Chn. Com. Burlington county, Green Bank; M. L. Jackson, Chn. Com. Atlantic county.

NEWARK, N. J.—The council of Harrison has taken the first steps toward building a bridge from Fourth St., Harrison, to Madison St., Newark.

WESTWOOD, N. J.—Bids are asked by the committee until July 13 for building two bridges at Woodcliff, with stone abutments, steel beams, and brick arches. I. D. Bogert, G. T. Haring, H. C. Bennett, Com.

PITTSBURG, PA.—The Munhall & Rankin Bridge Co. has been incorporated to build a highway bridge over the Monongahela River from Rankin to Munhall; capital stock, $1,000; Treas., Chas. F. Patterson, 118 Diamond St.——Local papers state that a charter has been applied for by the Allegheny & Chartiers Valley Bridge Co., with the following incorporators: Harding Kimberland, Miller Elliott, D. H. Ferrel, Henry J. Wenke, and Richard B. Scandrett. The purpose is to erect a new toll bridge over the Ohio River from a point at about Elliot and Esplen boroughs over to the lower end of the Allegheny River. The charter granted two years ago for a bridge at this location has expired. The new company claims to mean business and says $500,000 will be expended on the bridge, which is to be sufficiently elevated to clear the masts of any lake vessels that may come into Pittsburg harbor after the ship canal is completed.——The Drake & Straton Co. has been awarded the contract for rebuilding the 19th St. bridge over the Monongahela River by the erection of a steel structure. The bridge is the property of the Birmingham & Pittsburg Bridge Co., which has a capital stock of $100,000. Pres., J. H. Ricketson; Vice-Pres., J. B. Stevenson; Treas., J. C. Stevenson.

SCRANTON, PA.—The city engineer is preparing plans for a viaduct from the western end of the Linden St. bridge to the old Sweetland St. bridge.

TURTLE CREEK, PA.—We are informed that this borough will build a bridge over Turtle Creek.

ELKTON, MD.—Bids are asked by the board of county commissioners until July 23, according to reports, for building a number of iron and wooden bridges, 20 to 75 ft. in length.

PRINCE FREDERICKTOWN, MD.—It is reported that bids are asked by the board of road commissioners until July 15 for building a 400 ft. wood and iron highway bridge, on hard wood piles.

DEFIANCE, O.—Bids are asked by the commissioners of Williams and Defiance counties until July 23, according to reports, for constructing a masonry substructure for a steel bridge over Tiffin River, near Evansport, O. J. F. Van Behren, Audr. Williams County.

IRONTON, O.—Bids are asked until Aug. 1 for constructing the substructure and the superstructure of an iron and steel highway bridge, 210 ft. in length, over Storms Creek at Elm St. J. R. C. Brown, Cy. Engr.; Geo. H. Davies, Cy. Clk.

RICHMOND, IND.—A small bridge is to be erected in the city park. H. L. Weber, Cy. Engr.

ROCK ISLAND, ILL.—Bids are asked until Aug. 12 for a new superstructure and alterations of abutments and piers of the government bridge over the Mississippi River connecting Rock Island, Ill., and Davenport, Ia. About 900 cu. yds. of masonry will be required for abutments and piers, and the new superstructure will consist of eight spans—five fixed and one draw over and two elevated shore spans—of total weight, when erected complete, of about 8,770,000 lbs. Col. A. R. Buffington, Rock Island Arsenal.

JEFFERSON, WIS.—At a town meeting held July 3 it was voted to appropriate $2,000 for a new bridge across Rock River at Main St.

PAWNEE CITY, NEB.—Bids are asked by the commissioners of Pawnee county until July 15 for constructing seven bridges from 32 ft. to 64 ft. in length. Address T. A. Arneal.

WAYNE, NEB.—Bids are asked until July 19 for building eight bent bridges in Wayne county, according to reports, the bidders to furnish plans. S. B. Russell, County Clk.

HOT SPRINGS, ARK.—It is reported that the bridge commissioners, with County Judge Jones and Surveyor Voshell, are viewing different crossings on the river with the purpose of selecting a site to build one or more county bridges.

HEMPSTEAD, TEX.—J. I. Boggs, Engr., Houston, writes us that the contract for a bridge over the Brazos River, as noted in our issue of June 27, has been awarded to the Chicago Bridge Co., at $17,910; estimated cost, $22,872. The other bids were as follows: New Columbus Bridge Co., $18,800; King Bridge Co., $22,471; Missouri Valley Bridge Co., $19,995; Penn Bridge Co., $19,890; Wrought Iron Bridge Co., $24,323; Milwaukee Bridge Co., $18,584; Groton Bridge Co., $19,998; Southwestern Bridge Co., $18,695; G. E. King Bridge Co., $23,900.

FOREST CITY, ONT.—The London & Port Stanley Ry. Co. has awarded the contract for building two steel bridges over Kettle and Mill Creeks, near St. Thomas, as advertised in Engineering News, to the Dominion Bridge Co., at $39,660. The bridges are to be completed by Nov. 1.

BUILDINGS.

PROVIDENCE, R. I.—Bids are asked until July 24 for excavating and for constructing a masonry pier in the Moshassuck River at Promenade St. Robt. E. Smith, Comr. Pub. Wks.

BUFFALO, N. Y.—Green & Wicks, Archs., are preparing plans for a two-story brick and stone addition to the Buffalo state hospital, to cost about $70,000. ——Frederick Wing, Engr., White Bldg., has about completed plans for a six-story apartment house near the Circle, to cost about $100,000.——Mayor Jewett has submitted to the trustees of the city hall plans for enlarging the structure. The plans call for two wings and an additional story. The trustees are considering enlarging the hall, at an estimated cost of about $300,000.

GENESEO, N. Y.—Bids are asked by the committee until July 20 for erecting an additional building for the scientific and drawing departments, etc., of the Geneseo state normal school, and for the plumbing work of the new building. John Rorbach, John R. Strong and Wm. A. Brodie, Bldg. Com.

NEW YORK, N. Y.—W. A. Cable has been awarded the first prize by the committee on plans for a new clubhouse for the New York Athletic Club. The plans call for an eight-story granite and brick building, estimated to cost about $400,000.——Plans have been filed by J. L. Buttenweiser, 27 Pine St., for seven-story brick stores at 138 to 146 West 14th St., to cost $250,000; by Clarence S. Wadsworth, of Middletown, Conn., for a 10-story brick store and office building at 41 Union Square and 24 to 30 East 17th St., to cost $250,000; by Terence J. Duffy, of 215 West 71st St., for an eight-story brick store at 32d St. and 6th Ave., to cost $94,000.

SYRACUSE, N. Y.—Bids are asked until July 15 for constructing a stone arch over Harbor Brook at Park Ave., and for extending the stone arch culvert over the brook at West Genesee St. H. F. Stephens, Cy. Clk.

CAMDEN, N. J.—Bids are asked until Aug. 1 for erecting an armory. Address Adj.-Gen. Wm. S. Stryker, Trenton.

EAST ORANGE, N. J.—O'Connor & Metcalf, of New York, have prepared plans for a church for the Parish of Our Lady. The structure will be 70 × 175 ft., and is estimated to cost $106,000. Rev. Joseph P. Callaghan is the rector.

HOBOKEN, N. J.—Plans are asked until July 30 for a free library building. Edward Ross, Chn. Com.; T. F. Hatfield, Librarian.

PATERSON, N. J.—The board of freeholders has voted to build a new court house, at an estimated cost of $20,000.

KINGSTON, PA.—Bids are asked until July 19 for erecting an eight-room brick school building. Archs., C. Bach, of Kingston, and F. L. Olds, of Wilkes Barre; W. G. Colley, Secy. Bd. Education.

PHILADELPHIA, PA.—Joseph M. Houston has been engaged by the Presbyterian Board of Publication to prepare plans for an eight-story office building, 75 × 235 ft., at Juniper and Walnut Sts., estimated to cost $275,000. The building committee is composed of Col.

Wm. W. Allen, Robt. N. Wilson, Samuel C. Perkins, Thos. W. Synnott and Franklin L. Sheppard.

PITTSBURG, PA.—Milton J. Baird, of Pittsburg, agent for a company of capitalists, has secured a block of ground in the Bellefield district, fronting on Fifth Ave., between Craig and Neville Sts., on which the company will erect a seven-story hotel 400 ft. in length. The steel frame will be covered with buff brick, trimmed with red brick and terracotta. It will have 500 rooms and about 250 bath rooms, the cost, including furnishing, will be about $2,000,000. Arch., Henry Ives Cobb, Chicago. The plans will be ready for the contractors in a few weeks.

WASHINGTON, D. C.—Bids are asked until July 25 for erecting an amusement hall at the Soldiers' Home. Maj. Richard C. Parker.

PULASKI, VA.—Bids are asked by J. A. Loving until July 16 for erecting a two-story brick or stone jail, to contain 15 cells, with iron floors, etc.

RALEIGH, N. C.—Plans and specifications for a new brick dormitory and other improvements, at the North Carolina College of Agriculture and Mechanical Arts at Raleigh, have been prepared, and will be furnished prospective bidders on application to the chairman of the executive committee, W. S. Primrose.

GAFFNEY, S. C.—This city is to have a combined city hall and jail built of brick and stone, 60 × 120 ft., with steel and iron cages for the jail, etc. For plans and specifications, address the Mayor.

PORTLAND, IND.—We are informed that this city will build an infirmary at an estimated cost of $15,000 to $20,000.

RICHMOND, IND.—A correspondent sends us the following items: The Grand Opera House is to be remodeled at an estimated cost of $20,000. C. W. Bradley, Prop.——The county commissioners will purchase new boilers for the court house.——A. H. Bartel & Co. will erect a building for manufacturing purposes.

SOUTH BEND, IND.—A. W. Rush & Co., of Grand Rapids, Mich., are reported to have prepared plans for a new three-story stone court house for St. Joseph county, estimated to cost about $300,000. The building will be 180 × 125 ft., and will require 1,222,000 lbs. of steel in its construction.

KNOXVILLE, IA.—Plans are asked until July 30 for a court house for Marion county, the cost not to exceed $80,000. L. Van der Linden, Chn. Bd. Supervisors; James D. Gamble, County Attorney.

ST. PAUL, MINN.—Plans are asked by the state capitol commission until Sept. 5 for the new state capitol, estimated to cost $1,500,000. (Postponement of date from Aug. 5.) Four premiums will be awarded to the second, third, fourth and fifth best designs, of $1,000, $800, $700 and $500, respectively. The accepted design is to received no premium other than the fee, which, under the new competition, is to be 5% of the first $500,000, 4% of the second $500,000, and 2% on the remainder, with $5,000 additional on the satisfactory completion of the building. Channing Seabury, Vice-Pres. Com.

ST. LOUIS, MO.—Plans have been prepared for the Central Realty & Improvement Co. for a 12-story office building 288 × 127 ft., at Olive and Locust Sts. Archs., Reader, Coffin & Crocker, of Chicago; Secy., A. O. Rule.

RICHMOND, TEX.—R. Lee Eckman, Secy. Commercial Club, writes us that the county is about to build a new jail and extend the old one, but as yet no bids have been asked.

HAMILTON, ONT.—Bids are asked until July 19 for erecting a city jail. Arch., A. W. Peene, Wentworth Chambers; T. Beasley, Cy. Clk.

LONDON, ONT.—Plans are asked for a new building for the Young Men's Christian Association. Secy., Chas. R. Sayer.

TORONTO, ONT.—Bids are asked until July 16 for erecting a school building in Rosedale, and for enlarging and improving a number of others. C. H. Bishop, Supt. Bldgs.; W. W. Hodgson, Chn. Com.

RICHMOND, QUE.—Bids are asked until July 26 for erecting a post office building at this place. Address E. F. E. Roy, Secy. Dept. Pub. Wks., Ottawa, Ont.

WATER-WORKS.

AUBURN, ME.—The city has sold its water bonds to E. H. Rollins & Son, of Boston.

BELMONT, N. H.—A press report states that Archie Parsons, of Derry Depot, is making surveys for works at this place.

CENTER HARBOR, N. H.—The proposed works at this place was noted last week. A preliminary investigation has been made by Bartlett & Gay, of Manchester; J. S. Graves, Chn. Com.

CONTOOCOOK, N. H.—G. A. Curtice, W. S. Davis, D. F. Fiske, H. J. Davis and J. A. Fuller have been appointed a committee to investigate the question of works. The Contoocook Water-Works was incorporated by the last legislature, and it is stated that the corporation will issue bonds if the report of the committee is favorable. The supply will probably be taken from Gove's Pond, nearly four miles distant.

EXETER, N. H.—The citizens are reported as about to sink wells to secure a better supply.

PETERBORO, N. H.—Bartlett & Gay, of Manchester, have made preliminary investigations for works at this place, but we are informed that there is little prospect of any construction this season.

SOMERSWORTH, N. H.—D. F. Smith & Bro., of Boston, are sinking a test well for a new supply in this city.

JOHNSON, VT.—The contract for works, noted last week, is reported to have been awarded to Chas. L. Woodbury, of Burlington, Vt.

WEST RUTLAND, VT.—Bids are asked until Aug. 1 for a water-works franchise in this village, as stated in our advertising columns. The report of the committee, noted in our issue of June 27, estimated the cost of a plant, with about 11 miles of mains and 40 hydrants, at about $40,000. M. Odell, Chn. Com.

LYNN, MASS.—The board of aldermen has authorized the city treasurer to issue $40,000 in bonds for a stand-pipe on the Highlands, and $125,000 in bonds for a new storage basin. The bonds will mature in 1925 and bear interest at 4%.

MARLBORO, MASS.—The city has sold $22,000 of 4% 20-year water bonds to Brewster, Cobb & Estabrook at 107.14.

MELROSE, MASS.—The commissioners are reported as considering a partial introduction of the meter system.

METHUEN, MASS.—Jas. S. Howe, Town Clk., writes us that the $25,000 in bonds, noted last week, will be spent in extending the works, and that the commissioners will probably purchase the pipe and do the work by day labor. Address Daniel W. Tenney.

ROCKPORT, MASS.—At a special town meeting July 1 the taxpayers voted to issue $25,000 of additional water bonds to extend the works.

WALPOLE, MASS.—Freeman C. Coffin, Engr., Boston, writes us that the contract for 15 miles of pipe has been awarded to M. J. Drummond, and that Rensselaer gates and Ludlow hydrants will be used. The contracts for pumps and stand-pipe are not yet awarded.

CHESTER, CONN.—The Chester Water Co. is reported to have been incorporated to construct works, the supply to be from Watrous Pond.

NAUGATUCK, CONN.—The stockholders of the Naugatuck Water Co. have voted to raise the reservoir to 28 ft. The capital stock will probably be increased from $50,000 to $65,000.

NEW BRITAIN, CONN.—Bids are asked until July 20 for the purchase of $25,000 of 4% water bonds. Thos. S. Hall, Chn. Comrs.

WATERBURY, CONN.—Bids are asked until July 23 for the cleaning of the basin. R. A. Cairns, Cy. Engr.

ALBANY, N. Y.—The water board has awarded the following contracts: For foundations to two pumping engines, addition and improvements to boiler house and coal sheds, Michael J. Dady, at $41,579; removing five old boilers and setting up four new ones, James Hunter, at $4,547; laying water mains on Washington Ave., John S. Fitzgerald, at $291.

ANGELICA, N. Y.—A franchise has been granted to H. S. Hastings, of this place, and others, and it is reported that the construction of works will be commenced as soon as the plans and specifications are completed.

AFTON, N. Y.—The following contracts were awarded July 2: For cast iron pipe and special castings, Jackson & Woodin Mfg. Co.; hydrants and valves, Eddy Valve Co.; labor, Munson & Lewis, of Herkimer, N. Y. About 38,000 ft. of pipe, 34 hydrants and 17 valves will be required. The water supply will be from springs. Engr., J. Warren Lamb, Cooperstown, N. Y.

BALLSTON SPA, N. Y.—An election will be held July 11 to vote on the construction of works, according to plans prepared by Harvey M. Geer. Dr. E. S. Lawrence, Chn.; L. D. Sherwood, Secy. Comrs.

BUFFALO, N. Y.—Bids are asked until July 20 for constructing a tunnel from pumping station to intake pier and extending present intake pier. R. G. Parsons, Secy. Dept. Pub. Wks.

CAIRO, N. Y.—The village clerk writes us that it is not probable that works will be constructed at this place at present.

COLLEGE POINT, N. Y.—An election will be held July 29 to vote on an issue of $20,000 in bonds for a stand-pipe.

DANSVILLE, N. Y.—Plans for new works have been prepared by John Youngs, of Geneseo; estimated cost, $55,000 to $60,000. A public meeting will probably be held next week to consider the question of construction. J. H. Jackson, B. H. Oberdorf and F. W. Noyes are the committee.

DEPEW, N. Y.—We are informed that the water company has contracted with the Snow Steam Pump Works, of Buffalo, for a 3,000,000-gallon pumping engine, and that about $20,000 will be spent in improvements.

DUNDEE, N. Y.—We are informed that at the election July 1 the water-works proposition was defeated, 81 votes being cast against the proposition and 76 for it. Another election will probably be held.

HICKSVILLE, N. Y.—It is stated that cisterns are to be constructed for fire protection.

JAMAICA, N. Y.—The village trustees are again considering an issue of $200,000 in bonds for the purchase of the works, electric light plant, and for macadamizing the streets. It is reported that there is a strong feeling throughout the village in favor of the project.

LEROY, N. Y.—Jonathan Champlin, of Penn Yan, was at this place last week, by invitation of the water committee, searching for a water supply.

MONTGOMERY, N. Y.—The commissioners have sold the $23,000 of water bonds to Benwell & Everett, of New York, for $23,527.

NAPLES, N. Y.—Plans for works have been prepared by J. F. Witmer, of Buffalo.

NYACK, N. Y.—The trustees are reported about to organize a board of water commissioners, with a view to securing municipal works.——The Nyack Water-Works Co. is reported to have awarded a contract to C. F. Underwood, of Peekskill, for sinking 10 to 20 wells.

OGDENSBURG, N. Y.—At an election July 3 the citizens voted on an appropriation of $2,500 to pay its share of the expense of laying 3,500 ft. of 8-in. main in the Central Vermont R. R. Co.'s yards and adjoining territory.

ONEIDA, N. Y.—Charles Kellogg, of Chittenango, W. G. Tracy, of Syracuse and G. W. Dunn, of Binghamton, have been appointed by the court commissioners to appraise the plant of the water company for the village.

PERRY, N. Y.—The trustees are reported to have agreed upon a supply from Silver Lake, but we are informed that no engineer has yet been engaged to prepare plans. Population, 2,200. T. Harry Bussey, Pres. Bd.; C. M. Smith, Cy. Clk.

POTSDAM, N. Y.—S. C. Cram, Clk., writes us that there has not yet been any report of the committee on water supply, and that probably the matter will not be decided until the annual meeting next January.

UTICA, N. Y.—The contract for enlarging reservoir No. 4 has been awarded by the water company to the Troy Public Works Co. Frank K. Baxter, Engr. in Charge.

WARSAW, N. Y.—Bids are asked until July 25 for constructing works, including about 15 miles of 10 to 4-in. pipe, 100 hydrants, etc.; Engrs., Voorhees & Witmer, Buffalo; N. S. Bardslee, Pres. Comrs.

WILLIAMSVILLE, N. Y.—James Chalmers, Pres. Water Committee, writes us that no engineer has yet been engaged to prepare plans.

BORDENTOWN, N. J.—The council is reported to have granted a franchise to H. M. Sciple & Co., who will sink artesian wells, erect a stand-pipe and lay mains through the principal streets, the work to be commenced at once and to be completed within six months.

BEAVER MEADOWS, PA.—The Citizens' Water Co. of Beaver Meadows was incorporated July 9, with a capital stock of $4,000; Treas., John Martyn, Beaver Meadows.

BELLEVUE, PA.—Fred W. Kiefer, Pres. Council, is interested in securing a water supply at this place. It is proposed to have the borough lay the mains and secure a water supply from the Allegheny mains.

DUBOIS, PA.—The "Express" of this place states that plans for new works are under consideration, and that a charter will soon be applied for by a new company, which proposes to secure a water supply from mountain streams and springs.

EPHRATA, PA.—H. J. Hermes, Clk., writes us that an election was called for July 9 to vote on the construction of works, which will require about 6,000 ft. of 12-in., 8,000 ft. of 8-in. and 18,000 ft. of 6-in. pipe, 60 hydrants, reservoir, etc The supply will be from mountain springs.

HELLERTOWN, PA.—L. J. H. Grossart, of Allentown, has reported that a desirable water supply can be obtained from Cold Mountain about two miles distant, and it is reported probable that bonds will be issued for the construction of works.

MONACA, PA.—The contract for works has been awarded to Chandley Bros., of Beaver Falls, at $21,700, the other bids being John W. McIntyre, McKeesport, $21,841; Keeling Ridge Mfg. Co., of Pittsburg, $25,221; McLaughlin & Kelley, Rochester, Pa., $24,398; Corcoran Connell, Pittsburg, $23,500.

MOUNT CARMEL, PA.—J. E. White, Town Clk., writes us that no steps have yet been taken for the construction of works.

JEFFERSON, MD.—D. C. Shaff writes us that there are no prospects of the construction of works at this place.

MONROE, N. C.—We are informed that the Monroe Water-Works Co. is securing subscriptions, and that the construction of works will be commenced as soon as a sufficient amount of money is raised. The city has offered to pay $15,000 a year for 35 hydrants, and the railway company $2,500 a year. The supply will be from artesian wells. J. W. Stephenson, Mayor.

HAWKINSVILLE, GA.—An election will be held July 17 to vote on the question of works and electric lights. San Way, Mayor.

HIGH SPRINGS, FLA.—T. J. Thurman, Clk., writes us that nothing has yet been done to secure works.

ST. AUGUSTINE, FLA.—The city clerk writes us that no steps have been taken for the construction of new water-works.

CULLMAN, ALA.—G. A. Prinz, Secy. Comn., writes us that the bids received July 1 for constructing works were rejected, and that J. L. Ludlow, of Winston, N. C., has been engaged to prepare specifications and superintend the construction of works, for which new bids will be asked within a few weeks.

ABERDEEN, MISS.—The citizens are reported to have voted to construct works.

JACKSON, TENN.—The water-works trustees have been instructed to secure bids for an additional pump of 3,000,000 gallons capacity. S. C. Lancaster, Cy. Engr.

McMINNVILLE, TENN.—The council is reported as considering the immediate construction of works.

COLUMBUS, O.—Bids are asked until July 16 for furnishing one carload of soft pig lead for use of the water-works department. J. A. Fanning, Clk. Bd. Pub. Wks.

HAMILTON, O.—A contract has been awarded to J. B. Yingling to deepen 19 of the 6-in. wells and to put in new strainers.

FORT CLINTON, O.—The council has sold $7,000 of additional water bonds to Spitzer & Co., of Toledo, for $7,146. J. H. Faus, Clk.

ST. MARY'S, O.—M. J. Mooney, Jr., Clk., writes us that $50,000 in bonds will be issued for works, but that no water-works trustees have yet been elected or engineer engaged; population, 5,000.

WAPAKONETA, O.—Contracts for constructing works, as advertised in Engineering News, have been awarded as follows; Consult. Engr., Geo. Hornung, Cincinnati; Pumping machinery, John H. McGowan Co., Cincinnati, O., $3,980; pump house, receiving well, and pump foundations, Newmeyer & Ziegfelder, Wapakoneta, O., $4,118; water tower, Brownell & Co., Dayton, O., $7,350; foundations for same, to M. Stopper, Cincinnati, O., $4,068; pipe and specials, Michigan Peninsula Car Co., Detroit, Mich., $20,296; pipelaying, setting hydrants, etc., Wintz & Still, Wapakoneta, O., $6,271; fire hydrants, valves, etc., Michigan Brass & Iron Works, Detroit, Mich., $5,267. Some of the bids are published under Contract Prices.

WELLSVILLE, O.—The proposition to issue $35,000 in bonds for works was defeated at the election last week.

BLOOMINGTON, IND.—Henry A. Woollery has been appointed by the court to conduct the sale of the plant and franchise of the Bloomington Water Co. The date of the sale has not been decided upon.

EVANSVILLE, IND.—The water-works trustees have recommended the construction of a new pumping station, complete, at an estimated cost of $225,000. Peter Herrmann, Chn.

JASPER, IND.—It is stated that the citizens have voted, 5 to 1, in favor of issuing $15,000 in bonds for works. H. Pfau and Phil Kunkel, of the town board, are interested. A. J. Berger, Clk.

MONTICELLO, IND.—Bids are asked until July 26 for constructing works, as stated in our advertising columns. W. S. Shields, Chicago, Consult. Engr.; Web P. Bushnell, Engr.; Bert Van Voorst, Clk. Com.

MANISTIQUE, MICH.—We are informed that a spe-

cial election was called for July 10 to vote on an issue of $40,000 in bonds for works; water supply from artesian wells. V. I. Hixson, Clk.

MILFORD, MICH.—Geo. P. McCoy, Clk., writes us that the proposed works, for which $18,000 in bonds has been voted, as noted last week, will include two 750,000-gallon pumps, about 6,000 ft. of 8 and 6-in. and 20,000 ft. of 4-in. pipe, 30 to 40 hydrants, etc. Bids will probably be opened early in August. Engr., M. Walker, Fenton, Mich.

PETERSBURG, MICH.—H. J. Woolfa, Clk., writes us that no money has yet been appropriated for works in this village, and it is not probable that a plant will be constructed; population, 400.

CAMBRIDGE, ILL.—Bids are asked until July 29 for sinking an artesian well. It is stated that $25,000 in bonds have been voted for works, but that mains will not be laid until a water supply is secured. J. H. Seaton, Village Clk.

CHICAGO, ILL.—Bids are asked until July 16 for 1,500 tons of cast iron water pipe. W. D. Kent, Comr. Pub. Wks.

EFFINGHAM, ILL.—The council is reported to have granted a franchise for the erection of a $75,000 plant, the city contracting for 100 fire plugs at $35 each a year.

FORT SHERIDAN, ILL.—The contract for works, for which bids were received July 2, has been awarded to Frank Lang. The Crane hydrants and valves will be used. Engr., H. L. Bowen, Highland Park, Ill.

GALESBURG, ILL.—Bids are asked until July 15 for furnishing and laying 9,000 ft. of 16-in., 2,640 ft. of 8-in. and 2,845 ft. of 6-in. cast iron pipe, with 11 hydrants, 6 valves, etc. Chas. E. Wells, Supt. W. W.; A. W. Truedson, Cy. Clk.

GENOA, ILL.—Hill & Enricht, of Chicago, have been engaged to make plans and specifications for works.

GROSSDALE, ILL.—Plans for a system, which will include about 30 miles of pipe, are being made by Hill & Enricht, of Chicago.

LAWRENCEVILLE, ILL.—It is reported that an election will be held July 20 to vote on the question of constructing works, and that there is little doubt but that the proposition will carry.

LOCKPORT, ILL.—The village board has voted to appropriate $20,000 for a new water-works system.

MAPLE PARK, ILL.—Bids are asked until July 18 for constructing a system of water-works. W. E. Tweadwell, Chn. Com.; J. L. Snow, Village Clk.

VIRGINIA, ILL.—It is reported that a water company has been organized at this place, with a capital stock of $60,000, and that preliminary steps are being taken to put in works.

WARREN, ILL.—A press report states that works will be constructed at a cost of $20,000. P. T. Hicks has been engaged to prepare the plans and specifications. The supply will probably be from an artesian well.

BARABOO, WIS.—The council has condemned the present supply and instructed the water company to take immediate steps for improving the supply.

ELKHORN, WIS.—J. F. Lyon, Clk., writes us that the following bids were received July 1 for constructing works, as advertised in Engineerng News:

Samuel I. Pope, Chicago, Ill.	$23,367
William H. Wheeler & Co., Beloit, Wis.	23,800
Jas. Cape & Sons, Racine, Wis.	22,305
*The N. F. Reichert Co., Racine, Wis.	21,188
W. F. Wagoner & Co., Minneapolis, Minn.	23,983
Fairbanks, Morse & Co., Chicago, Ill.	23,680
George C. Morgan, Chicago.	23,923
C & T. Inglehart, Morgan Park, Ill.	22,287

* Awarded contract, Crane hydrants and valves to be used.

LA CROSSE, WIS.—The contract for constructing the intake into the river has been awarded to A. V. Fetter at $4,250, and that for extending it from the river to the well to A. V. Fetter at $1,475.

FOREST CITY, IA.—The new water-works plant has been satisfactorily tested. Crellin & Lovell, of Des Moines, were the engineers and contractors.

INDIANOLA, IA.—Geo. C. Morgan, of Chicago, has been awarded the contract for constructing works at this place.

LAWLER, IA.—James Curran, Cy. Recdr., writes us that the proposed works will probably cost about $3,800, but that no contract will be let before September if at all this year. Negotiations are now being made for plans and specifications.

LEWIS, IA.—By a vote of 8 to 9, the taxpayers have decided not to issue additional bonds to extend the water plant.

MADRID, IA.—The city recorder writes us that a franchise for works and electric lights has been granted to J. P. Anderson & Co., of Madrid.

POSTVILLE, IA.—The contract for a 70,000 gallon steel tank and tower has been awarded to Crellin & Lovell, of Des Moines.

KASSON, MINN.—Bids are asked until July 16 for constructing works. B. A. Shaver, Cy. Recdr., writes us that the plant will include a tower and tank, pump, about 3,000 ft. of mains, and is estimated to cost $6,000. Fairbanks, Morse & Co., of St. Paul, prepared the plans.

STEWARTVILLE, MINN.—B. W. Moore, Village Recdr., writes us that the contract for works has been awarded to Fairbanks, Morse & Co., of St. Paul, at about $5,000. The other bidders were J. G. Green, of Winona, and Sykes & Wanner, of Minneapolis.

INDEPENDENCE, KAN.—At a special election June 26 the proposition to issue $35,000 in bonds for the purchase of the works was defeated, lacking a few votes of the required two-thirds.

BUTTE, MONT.—Bids are asked until Sept. 18 for constructing works on a franchise plan, as described in our advertising columns. The city offers a 40-year franchise and to contract for 10 years for not less than 250 hydrants. F. W. Blackford, Cy. Engr.; A. A. McMillan, Cy. Clk.

OZARK, MO.—It is reported that Mr. Rogers, president of the Ozark bank, has been granted a franchise for works, which will be constructed this fall. The water supply will be from springs.

ST. LOUIS, MO.—The board of public improvements has appropriated $185,000 for pipe, valves, hydrants, etc.; $225,000 for high-service engines Nos. 9 and 10, and $70,000 for laying additional mains.

RICHMOND, TEX.—R. Lee Eckman, Secy. Commercial Club, writes us that the club is trying to get capital interested in the construction of works, and it is thought that a plant will be constructed this fall. The supply will be from an artesian well or from the Brazos River; population, 1,200.

GUTHRIE, OKLA.—The city engineer has prepared plans and specifications for improving the works, including a new intake tunnel.

ETIWANDA, CAL.—It is reported that an election will soon be held to vote on a proposed issue of $50,000 in bonds for improving the plant of the Etiwanda Water Co.

SAN FRANCISCO, CAL.—Press reports state that the recent fire will probably result in important extensions of the water mains and the addition of 1,000 hydrants, for which the fire department has petitioned several times.

HARTLAND, N. B.—D. Monroe, Supt. W. W., Woodstock, has been at this place investigating a proposed water-works plant which will soon be constructed, according to reports.

IRRIGATION.

PORTLAND, ORE.—Bids are asked for 70,000 cu. yds. of canal excavation, 45 miles south of The Dalles. Geo. W. McCoy, 284 Morrison St.

YUMA, CAL.—It is reported that a local irrigation company has been organized by M. F. Shaw, G. S. Marable, M. E. Cunningham, J. I. Toler, R. P. Marable, W. H. Moore and Duncan L. deVane, all of this place and county, with principal office in Yuma. The organizers have three sections of land 10 miles south of Yuma, near the Algodones grant. A pumping plant will be used, and for this purpose the company has purchased the duplex Knowles pump formerly used at the Queensbury placers, and moved it, with its boilers and apparatus, to its land. Water will be secured from wells, work on which will soon be begun.

NEW COMPANY.—Union & Jordon Irrigation Co., Salt Lake City, Utah; $31,500; Jesse Argent, Wm. B. Bennett, C. O. A. Lilyblad, James Winchester and others.

SEWERAGE.

BELFAST, ME.—The council has directed the committee to construct a sewer in two streets. Engrs., Parks & Wheeler.

RUTLAND, VT.—Bids are asked until July 13 for constructing 1,200 ft. of 50 to 41-in. brick sewers, 2,400 ft. 30-in. pipe, 1,900 ft. 24-in., 700 ft. 18-in., 700 ft. 12-in., 1,300 ft. 8-in., and 4,200 ft. 6-in. pipe sewers. Sidney Smith, Cy. Engr.

WOODSTOCK, VT.—A town meeting is soon to be held to vote on the question of buying the Sayward dam, which, it is reported, will be removed to make way for constructing a sewerage system.

BOSTON, MASS.—Bids are asked until July 15 for constructing 3,140 ft. of 18 to 10-in. pipe sewers, etc. B. T. Wheeler, Supt. of Streets.

EAST HAMPTON, MASS.—It is reported that bids will be asked for constructing sewers as soon as McClintock & Woodfall, of Boston, have completed the specifications.

GARDNER, MASS.—At a recent town meeting it was voted to appropriate $6,000 for extending the system in Woodland Ave.

LAWRENCE, MASS.—Bids are asked by the committee until July 25 for constructing Section 1 of the proposed sewer from Newton St. to the river, in Ward 6. Arthur D. Marble, Cy. Engr.

LOWELL, MASS.—The aldermen have passed a resolution authorizing an issue of $75,000 in bonds for sewers and $25,000 for paving.

TAUNTON, MASS.—The council has passed resolutions for extending and reconstructing sewers in four streets, at an estimated cost of about $7,000.

WILLIMANSETT, MASS.—The council has been petitioned to improve the system in this village.

ALBANY, N. Y.—Bids are asked until July 15 for constructing a 24 to 6-in. pipe sewer in North Pearl St. T. J. Lanahan, Clk. Bd. of Contract.

AVON, N. Y.—The citizens have voted to construct a system, at an estimated cost of $12,000 to $20,000.

BINGHAMTON, N. Y.—The street commissioners are considering the question of constructing a trunk sewer along the Chenango River.

BROOKLYN, N. Y.—Bids are asked until July 19 for constructing sewers in four streets. A. T. White, Comr. Cy. Wks.

BUFFALO, N. Y.—Bids are asked until July 23 for constructing 18 to 10-in. pipe sewers in two streets. R. G. Parsons, Secy. Dept. Pub. Wks.

COLLEGE POINT, N. Y.—The street committee has been directed to advertise for bids for constructing an outlet sewer in College Ave.

COXSACKIE, N. Y.—The commissioners are considering plans for a system, according to reports.

JAMAICA, N. Y.—John J. McLaughlin, Cy. Engr., has recommended the construction of a system, with the main sewer in South St. emptying into Jamaica Bay.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until July 18 for constructing a sewer in Cedar Place and for grading and improving Fort Independence St. Louis F. Haffen, Comr. St. Improvements.

LAKE PLACID, N. Y.—The supervisors of Essex county have authorized the town of North Elba to borrow $3,500 for a sewer in this village. Thomas Durgan, Town Clk.

ONEONTA, N. Y.—W. B. Rider has made surveys for extending a 24-in. sewer about 2,000 ft.

SYRACUSE, N. Y.—Bids are asked until July 15 for constructing 20 to 15-in. pipe sewers in three streets. H. F. Stephens, Cy. Clk.—It is proposed to construct 32 and 30-in. brick and 20 to 12-in. pipe sewers in five streets, at an estimated cost of about $15,000. Henry C. Allen, Cy. Engr.

WARSAW, N. Y.—The citizens are considering plans for a system in the North End.

BLOOMFIELD, N. J.—The contract for constructing about 7,233 ft. of 8-in. and 3,239 ft. of 20-in. pipe sewers, for which bids were opened July 8, as advertised in Engineering News, has been awarded to P. H. Harrison & Sons, of Newark, N. J. The itemized bids will be published in a later issue. Engr., A. H. Olmsted, Bloomfield.

CAMDEN, N. J.—Bids are asked by the street committee until July 19 for constructing sewers in nine streets, at an estimated cost of about $3,300.

JERSEY CITY, N. J.—Bids are asked until July 16 for constructing 500 ft. of 24-in. brick and about 2,000 ft. of 18 to 12-in. pipe sewers. J. C. Kaiser, Chn. Com.

TRENTON, N. J.—It is proposed to construct sewers in six streets. Consult. Engr., Rudolph Hering, New York. C. E. Murray, Clk. Council.

ALLEGHENY, PA.—Bids are asked until July 15 for constructing lateral sewers in six streets. Robt. McAfee, Dir. Pub. Wks.

CHAMBERSBURG, PA.—The council has voted to submit the question of constructing a system to the voters at a special election.

NARBERTH, PA.—The council is considering plans prepared by Goodman & Clothier for a drainage system on the north side of the railway, according to reports.

PHILADELPHIA, PA.—The director of public works has been directed to advertise for bids for constructing the following sewers: Allegheny Ave., estimated to cost $35,000; American St., $11,000; Chew St., $16,000; 58th St., $5,000; 57th St., $15,000; extension of George's Run sewer, $50,000; Jasper St., $12,000; Lefever St., $15,000; Mill St., $18,000; Milnor St., $15,000; Ontario St., $18,000; 20th St., $25,000; Woodland Ave., $12,000, and also sewers in a number of other streets.

PITTSBURG, PA.—The council has passed ordinances for constructing 15-in. sewers in about 23 streets.

CUMBERLAND, MD.—Geo. Kean and J. W. George have petitioned the council for permission to enlarge the Baltimore St. sewer from 12-in to a 24-in sewer.

WASHINGTON, D. C.—Bids are asked by the district commissioners until July 18 for a supply of sewer brick, as stated in our advertising columns.—The district commissioners have ordered the construction of stone sewers in nine streets and alleys.

COLUMBUS, O.—Plans for sewers have been presented to the state board of health for approval by Alliance, Ashtabula, Athens, Cincinnati, Cleveland, Evanston, Hamilton, Logan, Lorain, Marysville, Marietta, Nelsonville, St. Bernard, Tippecanoe City and Warren.

FINDLAY, O.—The city is considering the question of greatly improving the system, according to reports.

YOUNGSTOWN, O.—Press reports state that the board of health has taken action that will result in an entire change of the sewer system of Youngstown, which will involve a large expenditure when the improvements are completed. The state board of health will be called here in a few days, as the system of sewerage is believed to be one of the worst in the state. With few exceptions, all the sewers in the city will be torn out and new ones constructed. At present the outlet for all the sewage is almost in the heart of the city, and a radical change will be made in this respect also.

BRAZIL, IND.—Bids are asked until July 16 for constructing 1,000 ft. of 24-in. pipe sewers, according to report. F. W. Sisson, Cy. Engr.

HUNTINGTON, IND.—Bids are asked until July 29 for constructing 24 to 10-in. pipe sewers in four streets, and a 39×26-in. brick sewer in Tipton St. J. B. Vernon, Cy. Engr.

INDIANAPOLIS, IND.—Resolutions have been adopted for constructing 1,700 ft. of pipe sewers in two streets, the contract for which will be awarded about July 28. C. C. Brown, Cy. Engr.

INDIANAPOLIS, IND.—Resolutions have been adopted for constructing 1,075 ft. of 15-in. pipe to 24×36-in. brick sewer in an alley east of Broadway, for 1,925 ft. of 18 to 12-in. pipe sewer in College Ave., and for 2,250 ft. of 15-in. pipe to 39×26-in. brick sewer in Charles and Palmer Sts. The contracts for all this work are to be awarded about Aug. 1.—Plans have been ordered for a sewer in Charles and Seymour Sts. C. C. Brown, Cy. Engr.

SOUTH BEND, IND.—Bids are asked until July 22 for constructing a brick sewer in Main St. L. A. Bull, Cy. Clk.

GROSSDALE, ILL.—Bids will be opened about July 20 for a sewer system in West Grossdale. Engrs., Hill & Enricht, Chicago.

ELGIN, ILL.—The commissioners are reported as considering plans for a sewage disposal plant.

URBANA, ILL.—Bids are asked until July 24 for the construction of 880 ft. of 10-in. and 6,970 ft. of 8-in. pipe sewers in district No. 5, as stated in our advertising columns. G. W. Hubbard, Mayor; C. B. Holmes, Cy. Clk.

RACINE, WIS.—The board of public works has received bids from the following for constructing the Duck Creek sewer, estimated to cost $13,425: James Cape & Son, J. R. Jones, N. F. Reichert & Co., Fred Rasmussen & Co., William Forestal, Nash & Dowdle, Campbell, Dennis & Co., and James Markey. Geo. S. Bliss, Cy. Clk.

FORT DODGE, IA.—The council has rejected the bids for constructing sewers, and has ordered the clerk to readvertise for new bids.—The construction of a sewer in Second Ave. is being considered.

MASON CITY, IA.—The council has adopted an ordinance for engaging an engineer to prepare plans, etc., for constructing a sewer in the bed of Willow Creek.

KANSAS CITY, KAN.—The committee is considering the question of constructing a large sewer in ward 5, and a number of smaller sewers.

KANSAS CITY, MO.—The city engineer is preparing plans for a section of the O. K. Creek sewer, for which $40,000 has been set apart by the council. It is proposed to divide the work into four sections, and to begin with section No. 1 at the point where O. K. Creek flows into Turkey Creek. In order that the sewer may be constructed across the Southwest Boulevard before that thoroughfare is repaved, the work will be started as soon as the necessary ordinances can be prepared.

SPRINGFIELD, MO.—The city engineer has been

directed to advertise for bids for constructing sewers in a large number of streets in two districts. G. W. Hackney, Cy. Clk.

DENVER, COLO.—Bids are asked until July 15 for constructing a sewer in the Downing Ave. sanitary district. E. Monash, Pres. Bd. Pub. Wks.

PASADENA, CAL.—The city engineer has prepared plans for a system in the East Side.

OTTAWA, ONT.—The committee is considering the construction of two trunk sewers, one in Dalhousie ward and the borough of Hintonsburg, and the other in Ann St., through St. George's ward.

GARBAGE DISPOSAL.

BRIDGEPORT, CONN.—Local papers state that contracts for the garbage disposal plant have been awarded, and that the construction will be commenced this week.

CLEVELAND, O.—The mayor has announced himself in favor of some method of garbage cremation or utilization, and has recommended that steps be taken to investigate better methods of garbage disposal. No money is now available for the adoption of a new method. Last year the cost of garbage disposal amounted to $1,600.

COLUMBUS, O.—The Columbus Reduction Co. has been organized, and has submitted a proposition to the council to remove all garbage and dead animals from the city, and dispose of the same by a utilization process at $4.50 a ton. Dr. D. N. Kinsman, Supt. of Health, has approved the proposition of the company, but has reported that the price is much too high.

FORT WAYNE, IND.—The contract for a garbage crematory has been awarded to W. J. Willis, representing the Dixon Sanitary Cremation Co., of Findlay, O., at $7,875. W. W. Patrick bid $9,000 for a Rider crematory, and Brownlee & Co., of Dallas, Tex., $9,000 for a Brownlee crematory. These bids include buildings. A. J. You, Clk. Bd. Pub. Wks.

SAN ANTONIO, TEX.—The city physician is reported as stating that unless improvements are made at once in the method of garbage removal there will be much sickness in the city this summer.

STREETS AND ROADS.

BOSTON, MASS.—Bids are asked by the metropolitan park commission, Ames Bldg., until July 19 for building the Malden section of the Middlesex Fells Parkway. Wm. T. Pierce, Engr., 13 Exchange St.

NEW BEDFORD, MASS.—Bids are asked until July 16 for constructing about 5,000 sq. yds. of Trinidad Lake asphalt paving upon 6 ins. concrete foundation, as stated in our advertising columns. W. F. Williams, Cy. Engr.; W. S. Cook, Clk. Bd. Pub. Wks.

REVERE, MASS.—The town is considering a resolution appropriating $50,000 for street improvements. Jonathan Stone, Michael Sullivan, Com.

ALBANY, N. Y.—Bids are asked until July 15 for paving a portion of State St. with granite blocks. T. J. Lanahan, Clk. Bd. Contract.——The board has recommended the repaving of Central Ave. with brick and Canal St. with granite blocks, and has directed that specifications be prepared for paving portions of three streets with granite blocks and one with brick. ——The council is considering the question of paving portions of seven streets. W. W. Dennin, Clk. Council.

BROOKLYN, N. Y.—Bids are asked until July 23 for flagging sidewalks in portions of 35 streets. A. T. White, Comr. Cy. Wks.

BROOKLYN, N. Y.—Bids are asked until July 16 for paving and repaving portions of four streets with asphalt. A. T. White, Comr. Cy. Wks.——The aldermen are considering the question of paving portions of 16th St. with asphalt at an estimated cost of $53,000, and portions of five other streets with the same material at an estimated cost of about $31,000.

JAMAICA, N. Y.—Press reports state that a crusade in the direction of road improvement has been started by the Tamaqua wheelmen of this village. The club has originated a proposition to expend the sum of $50,000 on the village streets. Granville Yeaton, a member of the club, has been indorsed for the office of village trustee to fill the place of Trustee Carter, who recently resigned. The election will be held July 31 and the proposition to improve the streets will be voted upon at that time.

JAMESTOWN, N. Y.—Bids are asked until July 15 for paving portions of two streets and one alley, as stated in our advertising columns. John Conway, Pres. Bd. Pub. Wks.

NEWBURG, N. Y.—Bids are asked by the trustees until July 15 for paving Main St. with brick, granite blocks or asphalt.

NEW YORK, N. Y.—Bids are asked by the department of public parks at the Arsenal, Central Park, until July 17 for paving with telford pavement the road between Broadway and Van Cortlandt station of the Putnam division of the New York Central & Hudson River R. R., and the Gun Hill road from the station to Jerome Ave., in Van Cortlandt Park, 24th ward. The work includes the following materials: 200 cu. yds. excavation, 10,750 sq. yds. of telford pavement, 120 cu. yds. of dry rubble masonry in culverts, 2,300 lbs. of vitrified stoneware pipe in place, 1,400 sq. yds. rubble or cobblestone pavement in gutters.

NIAGARA FALLS, N. Y.—The council has voted to pave Main St. with asphalt, at an estimated cost of $5,400. S. F. Arkush, Cy. Clk.

POUGHKEEPSIE, N. Y.—The council has voted to advertise for bids for paving Union St. with asphalt blocks and Garden St. with brick.

ROCHESTER, N. Y.—The council proposes to pave Child St. with asphalt blocks, at an estimated cost of $28,800.

WALDEN, N. Y.—Bids are asked until July 15 for paving Main St. with brick or asphalt blocks. H. Hollingsworth, Clk. Trustees.

JERSEY CITY, N. J.—Bids are asked until July 16 for 6,000 sq. yds. of stone paving, 1,500 sq. yds. of Trinidad Lake asphalt paving, 6,650 cu. yds. of earth excavation, about 2,000 cu. yds. of rock excavation, 2,325 cu. yds. of sand and gravel filling, 1,222 sq. yds. of flagging, etc. John C. Kaiser, Chn. Com.; I. W. Startup, Clk. Pro Tem. St. Comrs.

NEWARK, N. J.—The Franklin township committee has directed the clerk to advertise for bids for 2,500 ft. of macadam road.

NEWARK, N. J.—The commissioners have passed ordinances for paving portions of about 30 streets with brick, granite blocks, asphalt, etc.; A. M. Linnett, Clk Bd. Comrs.; J. C. Mundy, Gen. Supt. Wks.

TRENTON, N. J.—The council has passed an ordinance for paving West State St.

TRENTON, N. J.—It is proposed to pave a number of streets with brick and construct sewers. C. E. Murray, Cy. Clk.

ALLEGHENY, PA.—The Fidelity Title & Trust Co., of Pittsburg, has purchased the $800,000 of street and sewer bonds for $852,320.

BELLEVUE, PA.—Bids are asked until July 13 for grading Rodgers Ave. Engrs., Trimble & Miller, 156 Fourth Ave., Pittsburg, Pa.; W. J. Longmore, Chn. Com., Bellevue.

PHILADELPHIA, PA.—Bids are asked until July 15 for resurfacing, macadamizing, etc., portions of several streets. Thos. M. Thompson, Dir. Pub. Wks.

PITTSBURG, PA.—William Brown, Cy. Engr., has been appointed engineer of the proposed macadamizing and construction of about 400 miles of roads in Allegheny county. Surveys will be commenced at once, but it is not probable that much construction will be done this year. The present system of toll roads will be abolished.

SHAMOKIN, PA.—The citizens have decided to engage three surveyors at once to prepare plans for grading and paving the streets of Springfield and Marshallton, at an estimated cost of $10,000.

BALTIMORE, MD.—Bids are asked until July 22 for constructing a granolithic pavement at Hanover and Ostend Sts. J. T. Oster, Inspector Bldgs.

LAUREL, MD.—W. E. Anderson has been awarded the contract for improving Main St. at $23,495.

WASHINGTON, D. C.—The district commissioners have prepared a map of the proposed permanent system of highways in the district, within the area bounded by North Capitol St., Rock Creek, Florida Ave., and the district line. Gen. Wm. P. Craighill, Ch. Engrs., U. S. Army.

MOBILE, ALA.—Bids are asked until Aug. 1 for paving Commerce St., from Government St. to St. Louis St., with granite blocks, as stated in our advertising columns. Chas. E. McLean, Chn. Com.

CINCINNATI, O.—Bids are asked by the board of administration until July 15 for paving two streets with brick.

CLEVELAND, O.—Bids are asked until July 13 for paving a portion of the Wooster Turnpike with brick. Julius C. Dorn, Clk. County Comrs.

TOLEDO, O.—The council is reported about to be petitioned to pave Albion St.

INDIANAPOLIS, IND.—Resolutions have been passed for 1,239 lin. ft. of asphalt paving in 10th St., the contract to be awarded about Aug. 7.——Several cement sidewalks and gravel streets have also been ordered. C. C. Brown, Cy. Engr. Bids are asked until July 13 for 6,143 sq. yds. of asphalt paving on 4 ins. Portland, cement concrete; until July 16 for 10,048 sq. yds. asphalt paving on 6 ins. Portland cement concrete; and until July 18 for 3,599 sq. yds. of asphalt paving on 6 ins. Portland cement concrete, and for 12,705 sq. yds. of cedar block paving on Portland cement concrete. C. C. Brown, Cy. Engr.——Resolutions have been passed for cement sidewalks in Jefferson Ave., 3,148 ft. in length, the contract to be awarded about Aug. 10.

MARION, IND.—Bids are asked until July 16 for about one mile of brick paving. Engr., L. M. Overman; John Watts, Cy. Clk.

DETROIT, MICH.—The board of public works has received the following bids for paving Cadillac Square with asphalt: Warren-Scharf Asphalt Paving Co., $21,263; Western Bermudes Paving Co., $24,376. The lowest bid is about $3,000 above the estimated cost of the work, and it is probable that the bids will be rejected.

SAGINAW, MICH.—Bids are asked until July 20 for paving a portion of Genesee Ave. with asphalt, estimated to cost $23,525; another portion of Genesee Ave. with brick, estimated to cost $20,394, and Janes St. with brick, estimated to cost $5,851. R. F. Johnson, Clk. Bd. Pub. Wks.——The city engineer has prepared plans for paving Potter St.

DE KALB, ILL.—L. B. Merriam, Consult. Engr. Dixon, writes us that the council has passed an ordinance to pave Main St. with brick on crushed stone foundation.

EAST ST. LOUIS, ILL.—Bids are asked by the mayor until July 20 for 7,000 sq. yds. of brick paving, 1,700 ft. of pipe sewers, etc. —Ordinances have been introduced in the council for paving portions of 20 streets with brick for a distance of about 10 miles. Bonds for $1,500,000 will be issued in five installments to cover the expense of the proposed improvements.

GROSSDALE, ILL.—Bids will be received in about a week for paving the streets in West Grossdale. Engrs., Hill & Enricht, Chicago.

BOONE, IA.—The city engineer has submitted plans for 20,500 sq. yds. of paving in Story St., estimated to cost about $32,000.

DUBUQUE, IA.—The city engineer has prepared plans for paving Locust St. with brick.

ST. LOUIS, MO.—The board of public improvements has awarded the following contracts for brick paving to Claus Vieths: Finney Ave., $11,562; Delmar Boulevard, $24,742; Euclid Ave., $7,360; Sarah St., between Laclede and Olive, $18,573; Sarah St., between Olive and West Belle, $12,676; and Taylor Ave., $16,636. The board rejected all bids for paving Washington Boulevard, between Taylor and King's highway, with asphalt. The lowest bid was that of P. S. Marquis, at $21,312.

PORTLAND, ORE.—Bids are asked until July 15 for constructing a wagon road from Fort Canby, Wash., to North Head, Cape Disappointment, Wash. Maj. Jas. C. Post, Lighthouse Engr., U. S. Army.

TORONTO, ONT.—Bids are asked until July 13 for paving two streets with cedar blocks and Avenue road with asphalt. Daniel Lamb, Chn. Com. on Wks.

MANUFACTURING PLANTS.

BURLINGTON, VT.—The Wells & Richardson Co., patent medicine manufacturers, of Burlington, is having plans prepared for enlarging its plant.

PHILADELPHIA, PA.—Hales & Ballinger, engineers, are reported as preparing plans for a five-story and basement factory building for Wm. P. Datz & Bro., 24 and 26 Decatur St., at 237-239 North Sixth St. The equipment will include two 75-HP. boilers, engine, steam heating and electric light plant, etc.

CHARLOTTE, N. C.—The Myrton Knitting Mills, at this place, will double the present capacity of the plant by adding 30 or more machines. A new engine and boiler will also be purchased.

DURHAM, N. C.—The Erwin Cotton mills at this place are to have a brick addition, two stories in height and about 100 × 200 ft., and doubling the present size of the mills, built and equipped at once, at a cost of about $100,000. Address W. A. Erwin, Secy.

MADISON, N. C.—A cotton spinning mill, to be operated by water power, is to be built on the Dan River, near this place, and equipped with the best modern machinery. Among those interested is the firm of F. & H. Fries, proprietors of the Wachovia mills, Salem.

ALICE, S. C.—The Marlboro Mfg. Co. has been organized to build a cotton mill at this place, with a capital stock of $40,000. The equipment will include 4,000 to 5,000 spindles, and also an electric light plant. H. H. Newton, B. D. Moore, A. T. Manship and S. B. Moore are among the incorporators.

CLIFTON, S. C.—C. E. Converse, of Spartanburg, and associates, will equip cotton mill No. 5 at this place, the buildings of which are now being completed, and will also build several brick stores, residences and offices for the use of the mill's officers and operatives.

BIRMINGHAM, ALA.—A press report from this city July 8 states that the Thurlow Mfg. Co., of Chester, Pa., has purchased a site in Birmingham for the removal of its 5,000-spindle yarn mill to the South. J. B. Cotton, president of the company, made a trip through the South recently and decided that the South is the coming cotton mill country. This company owns a mill in North Carolina, besides the one intended for Birmingham.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

TELEPHONE EXCHANGE.—McMinnville, Tenn.—It is reported that a telephone exchange will soon be established at this place.

LEVEES.—Rock Island, Ill.—Bids are asked at the U. S. Engineer Office until Aug. 5 for constructing 700,000 cu. yds. of levees, as stated in our advertising columns.

CASTINGS, ETC.—Springfield, Mass.—Bids are asked until July 25 for furnishing steel and iron castings, lumber and other supplies for the Springfield armory. Col. A. Mordecai, Ordnance Dept., U. S. A.

UNDERGROUND CONDUITS.—Cincinnati, O.—Bids are asked by the fire trustees until July 30 for constructing underground conduits for the fire department. Engr., J. A. Stewart, Johnston Bldg.; D. W. Sheid, Secy.

STREET CLEANING AND SPRINKLING.—Buffalo, N. Y.—Bids are asked by the department of public works until Juy 19 for sprinkling, sweeping and cleaning the improved streets for three years. The bids recently received for this work were rejected, as it was found that no notice of intention had been published previous to the advertising for bids.

STONE AND PIER WORK.—New York, N. Y.—Bids are asked by the department of docks until July 23 for furnishing about 2,000 cu. yds. of small cobblestone, 5,000 cu. yds. of riprap stone, 1,200 cu. yds. of sand and 2,500 cu. yds. of broken stone; also for repairing pier, new 43, near the foot of Barrow St.

IRON PILES.—San Francisco, Cal.—The following bids were received by A. S. Kimball, Q. M. G., U. S. Army, June 24, for iron piles:

Risdon Iron & Locomotive Wks., San Francisco.	$27,560
T. Thomson, 9 Mission St., San Francisco....	20,800
Cotton Bros. & Co., Oakland, Cal.....	21,655
J. M. McMahon, 200 Spear St., San Francisco..	21,780
W. H. Healy, 27 Stewart St., San Francisco...	22,974
P. F. Duddon, 137 Market St., San Francisco..	26,360
J. M. Taylor, 42 Market St., San Francisco....	19,432
F. A. Koeltz, 4 California St., San Francisco..	20,715

TIMBER.—Ottawa, Ont.—Bids are asked until Aug. 30 for the green standing pine, spruce and tamarac timber over 9 ins. in diameter at the stump, and all dead and fallen timber on the Temiscamingue Indian Reserve, which contains an area of 60 sq. miles and is situated at the head of Lake Temiscamingue, in the county of Pontiac, Que.; also for the pine timber on the Wahnapitae Indian Reserve, situated on the north shore of Lake Wahnapitae, in the District of Nipissing, Ontario, containing an area of four square miles. Hayter Reed, Deputy Supt. Gen. Indian Affairs.

CONTRACT PRICES.

CAST IRON PIPE.—Walpole, Mass.—A contract for 15 miles of cast iron water pipe has been awarded to M. J. Drummond, of New York, at $22.30 per ton, to be delivered by rail. Engr., Freeman C. Coffin, of Boston.

SEWERS.—Plainfield, N. J.—The following bids were received July 8 for constructing 32,000 lin. ft. of 4-in. house connections from the sewers proper to the curb lines, the contract being awarded to John Siddall, at $5,313:

Bidder.	Sections A, 1,900 ft.	B, 1,650 ft.	C, 1,700 ft.	D, 15,100 ft.	E, 10,900 ft.	F, 750 ft.	Total.
	cts.						
P. T. Plunkett, Jersey City, N. J.	27	27	27	27	27	27	$8,640
John Siddall, Trenton, N. J.....	19	18	18	18	14	14	5,313
John H. Hurley, Trenton, N. J...	25	22	25	22	20	19	6,907
Bernard Brady, Plainfield, N. J...	29	29	29	29	29	29	9,280
Amos Andrews, Plainfield, N. J....	38	35	35	30	30	30	9,919
Thos. Dood, North Plainfield, N. J.	30	30	30	28	28	28	9,065
M. Honan & Sons, Chester, Pa...	27	25	23	19	19	27	6,459

PIG LEAD.—Minneapolis, Minn.—The water-works department has awarded a contract for a carload of pig lead to Janney, Semple & Co., at 3.195 cts. per lb.

PLATE GIRDERS.—Syracuse, N. Y.—W. R. Hill, Ch. Engr. Water Board, received the following bids July 8 for furnishing two plate girders 45 ft. long, one 65 ft. long and one 67 ft. long, as advertised in Engineering News; standard weight of 45-ft. girder,

5,150 lbs.; 65-ft., 7,250 lbs.; 67-ft., 7,450 lbs.; transverse angles, I-beams, etc., 1,300 lbs.; girders to be delivered f. o. b. cars in Syracuse:

	Per lb.	Total.
*Buffalo Bridge & Iron Wks., Buffalo	$0.026	$683.80
Wrought Iron Bridge Co., Canton, O.	.0425	1,117.75
King Bridge Co., Cleveland, O.	.044	1,157.20
Hilton Bridge Co., Albany, N. Y.	.0275	723.25
G. W. Pulver & Co., Syracuse	.04	1,052.00
Toledo Bridge Co., Toledo, O.	.043	1,130.90

* Awarded contract.

BRICK PAVING.—Springfield, Ill.—Bids were opened July 2 for paving portions of seven streets with brick on 6 ins. of concrete foundation, and it is reported probable that the contracts will be awarded to Henry Welch, of Springfield, at $1.14 to $1.20 per sq. yd., according to the street and quality of brick used. The other bids were as follows: H. L. Pierce & Son, Lincoln, Ill., $1.31 to $1.34; Patterson & Stiffler, Springfield, $1.18 to $1.22; Talbot Paving Co., Peoria, $1.19 to $1.24; Rockford Construction Co., Rockford, Ill., $1.30 to $1.35; John F. Bretz & Son, Springfield, $1.16 to $1.22; Thos. White, Springfield, $1.30 to $1.45.

LEAD PIPE.—Syracuse, N. Y.—The contract for 50,000 lbs. of 1½ to ½-in. AAA lead pipe, as advertised in Engineering News, has been awarded to Merrie, Verhage & Co., of Cincinnati, at 3.66 cts. per lb., according to reports.

SEWERS.—Grinnell, Ia.—The contract for constructing 9½ miles of sewers, as advertised in Engineering News, has been awarded to Hanlon & Knepper, at $27,594, two-ring brick being adopted for the 30-in. sewer. The plans were prepared by the Iowa Engineering & Construction Co., of Clinton, Ia., Chas. P. Chase and Arthur J. Cox being the constructing engineers. The plans provide for ultimate disposal of the sewage by intermittent filtration. The bids were as follows:

concrete, 2,325 ft. of stratified limestone curb, 205 ft. of granite round corners, 342 ft. of marginal stone. The Western Paving & Supply Co. received the contract at $5.44. Other bids were $5.55 and $6.86.

CAST IRON PIPE.—Worcester, Mass.—Local papers state that the water commissioners have awarded a contract for 1,160 tons of 24-in. pipe and 10 tons of special castings to the Anniston Pipe & Foundry Co., at $19.20 per ton of 2,000 lbs. for the pipe and 2 cts. per lb. for special castings, the other bids being as follows: Warren Foundry & Machine Co., $20 and 2¼ cts., respectively, for pipe and specials; Reading Foundry Co., $20 and 2¼ cts.; McNeal Pipe & Foundry Co., $20 and 2½ cts.

BRICK PAVING.—Hammond, Ind.—W. F. Bridge, Cy. Engr., writes us that the contract for brick paving, for which bids were opened June 25, was awarded on July 2 to Wm. Moellering & Son, of Fort Wayne, Ind., at $1.80 per sq. yd. for paving on 5 ins. concrete foundation, with Murphy's grout filler.

GRANITE PAVING.—Albany, N. Y.—The contract for paving Clinton Square with granite blocks has been awarded to Peter H. Reynolds at $2.55 per sq. yd. for paving, 70 cts. for new curbing, 20 cts. for crosswalks, 10 cts. per sq. yd. for relaying granite, and 20 cts. per ft. for resetting old curb.

CEDAR BLOCK PAVING.—Detroit, Mich.—The lowest bids for paving portions of four streets with cedar blocks were as follows, the prices being considered unusually low: Iroquois Ave., from Jefferson to Agnes Aves., William Lappin, $5,000, or $1.43 a sq. yd.; Seminole Ave., from Jefferson to Agnes Aves., William Lappin, $5,434, or $1.43 a sq. yd.; Burns Ave., from Jefferson to Agnes Aves., William Lappin, $4,391, or $1.39 a sq. yd.; Campbell Ave., from Wabash tracks to Fort St., Talbot Paving Co., $3,747, or $1.27 a sq. yd.

STONE PAVING.—Allegheny, Pa.—The following contracts have been awarded: Booth & Flinn, repaving Zanesville Sewer Pipe & Brick Co., Zanesville, O., Bolens brown granite block No. 8, 98 cts.; Bolens make of Hallwood block No. 9, $1; Bolens brown granite and Bolens Hallwood block No. 10, 89 cts.; T. B. Townsend Brick & Contracting Co., Zanesville, O., Hallwood block, $1.01; Townsend block, 99 cts. W. S. Harris & Bro., Zanesville, O., Harris pavers, $1.01. Athens Brick Co., Athens, O., Athens blocks, repressed, 94 cts.; do. brick, 93 cts. Imperial Shale Brick Co., Canton, O., Metropolitan block, 94½ cts. Chas. Warner Co., Wilmington, Del., sample No. 23, 89 cts.; No. 20 wire cut, $1.10; No. 20 repressed, 98½ cts.; No. 21, $1.03; No. 22 square brick, $1; No. 22 repressed, $1.04. New England Steam Brick Co., Providence, R. I., Barrington brick, 90 cts. Harvey J. Wiley, Secy. St. Dept.

SEWERS.—Lincoln, Neb.—The following bids were received June 29 for constructing 2,036 ft. of 20-in. pipe sewers; Adna Dobson, Cy. Engr.

Quantities.	Joseph McGraw.	*Sheely & O'Shee.	Korsmeyer P. & H. Co.
20-in. pipe sewer, per ft.	$0.85	$0.81	$0.84
Manholes, per ft.	4.00	4.23	4.25
Moving iron pipe and valve.	100.00	97.50	$25.00
Total	$1,923	$1,844	$2,133

* Awarded contract.

BREAKWATERS.—Block Island, R. I.—The contract for constructing breakwaters has been awarded to S. & E. S. Belden, of Hartford, Conn., at $92.50 for planking, $10 each for 160 piles, $1.33 per ton for 20,200 tons of stone, and $9,500 for 85,000 ft. of pile sheathing. Chas. F. Stoll, New London, Conn., bid $1.35 per ton for stone; B. B. Sheldon, Esquopong, R. I., $92.50 for planking and $10.50 for each pile; J. A. Daily & Sons, of Providence, $125 for planking and $12 for each pile, and Wm. H. Molthrop & Co.,

BIDS RECEIVED AT GRINNELL, IA., JULY 1, 1895, FOR CONSTRUCTING SEWERS.

Bidder.	8-in., 27,200 ft.	10-in., 12,950 ft.	12-in., 1,278 ft.	15-in., 2,720 ft.	18-in., 0 to 4 ft. cut, 1,340 ft.	18-in., 4 to 6 ft. cut, 190 ft.	18-in., 6 to 8 ft. cut, 147 ft.	18-in., 8 to 10 ft. cut, 150 ft.	18-in., 10 to 12 ft. cut, 195 ft.	18-in., 12 to 14 ft. cut, 95 ft.	18-in., 14 to 16 ft. cut, 80 ft.	18-in., 16 to 18 ft. cut, 10 ft.	18-in. in sil, 750 ft.	20-in., 1,330 ft.	24-in., 1,500 ft.	30-in. 2-ring brick, 1,150 ft.	30-in. 1-ring brick, 1,150 ft.	30-in. vitrified pipe, 1,150 ft.	24-in. c.i. pipe, 100 ft.	15-in. c.i. pipe, 24 ft.	Manholes, 78.	Comb'd manhole and flush tank.	Flush tanks, 33 or more.	4-in. drain-tile, 3,000 ft.	¾-in. galv. iron pipe, 10,000 ft	Earth embankment, 600 cu. yd.
Hanlon & Knepper, Sioux City	$0.22	$0.27	$0.36	$0.45	$0.90	$0.93	$1.05	$1.10	$1.20	$1.45	$1.55	$1.65	$0.90	$1.63	$1.75	$1.90	$1.45	$2.35	$3.00	$1.75	$35.00[1]	$75.00	$60.00	$0.06	$0.10	$0.30
J. Kehoe & Co., Des Moines, Ia.	.295	.37	.42	.47	.60	.60	.60	.60	.60	.60	.60	.60	.60	.78	1.05	2.10	1.90	1.90	2.50	2.00	31.25	75.00	55.00	.025	.09	.20
G. J. Baer, Kansas City, Mo.	.28	.333	.45	.51	.50	.57	.64	.71	.78	.85	.92	1.00	1.00	1.15	1.15	2.23	1.42	2.10	3.50	2.00	25.00[2]	75.00	50.00	.05	.18	.25
B. P. Egan, Nebraska City, Neb.	.285	.33	.415	.49	.475	.515	.54	.555	.57	.66	.71	.82	.66	.915	.995	2.28	1.23	2.12	[1]—000.00—[1]		42.00	105.00	69.50	.05	.10	.20
S. Katz & G. R. Crandell, Omaha.	.29	.375	.435	.51	.40	.42	.45	.53	.55	.65	.68	.75	.55	.86	1.03	2.25	1.39	1.85	4.84	3.50	40.00[3]	90.00	64.00	.05	.15	.20
G. S. Miller & Co., Ottawa, Ill.	.27	.46	.50	.60	.55	.57	.64	.72	.76	.95	1.05	1.12	.75	1.06	.98	2.40	1.20	2.40	3.75	2.75	34.00[4]	80.00	53.00	.04	.09	.25
C. A. Olson & Co. Marshalltown, Ia	.34	.44	.49	.595	.73	.73	.73	.73	.73	.73	.73	.73	.73	.85	1.25	1.90	1.55	2.25	2.95	1.50	29.85	85.00	59.00	.05	.06	.20
F. McLellan, St. Paul, Minn.	.37	.43	.50	.60	.48	.50	.53	.55	.60	.75	.80	.85	.43	.80	.90	2.25	1.55	2.15	2.00	1.59	30.00[5]	110.00	80.00	.015	.12	.25
Dubuque Const'n Co., Dubuque, Ia	.30	.43	.52	.60	.49	.55	.63	.71	.75	.85	.98	1.13	.48	1.03	1.13	2.50	1.18	2.30	3.60	2.00	40.00	75.00	70.00	.04	.16	.20
B. B. Rourk, Des Moines, Ia.	.33	.43	.54	.85	.61	.63	.66	.85	.95	1.01	1.19	1.38	.75	1.38	1.25	2.60	2.10	2.13	3.00	2.50	22.50[6]	72.50	50.00	.05	.11	.30
Wickham Bros., Council Bluffs.	.35	.47	.50	.75	.55	.58	.63	.69	.78	.82	1.09	1.29	.55	.90	1.20	2.20	1.80	2.30	4.25	3.00	35.00	75.00	60.00	.06	.10	.25
Kavanagh & O'Connell, Des Moines	.32	.39	.49	.71	.62	.65	.67	.69	.73	.75	1.01	1.11	.78	1.69	2.00	2.60	2.30	2.65	3.25	2.50	33.00	80.00	55.00	.05	.06	.25
Edwards & Walsh Co., Davenport.	.38	.54	.62	.68	.52	.58	.64	.69	.75	.81	.87	.93	.47	.91	.96	1.85	1.30	1.85	3.50	2.00	32.00[7]	65.00	55.00	.08	.12	.30
Rockford Const'n Co., Rockford, Ill	.40	.56	.73	.82	.63	.66	.70	.77	.87	1.00	1.40	2.00	.68	1.46	1.35	2.13	1.25	2.20	3.75	2.80	40.00	102.00	62.00	.04	.10	.50
Porter, Bowlin & Hadley, Tipton.	.30	.54	.60	.70	.78	.82	.87	.92	.97	1.02	1.07	1.12	.67	1.20	1.45	3.15	2.31	2.20	4.50	2.55	80.00	86.60	85.70	.035	.065	.28
Bryan & Youngerman, Des Moines.	.74	.79	.95	1.10	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.02	1.37	2.99	1.59	2.39	1.75	1.00	20.75	58.18	58.18	.05	.08	.35
King & Kennedy, Des Moines, Ia.	.31	.36	.37	.45	.55	.59	.63	.70	.78	.87	1.05	1.25	.75	.89	1.25	2.00	1.60	2.05	4.60	3.25	30.00	55.00	33.00	....	.0875	.40
Berry & Welch, Iowa City, Ia.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

[1] $35 and $39. [2] $25 and $27. [3] $40 and $45. [4] $34 and $39. [5] $30 and $35. [6] $22.50 and $25. [7] $32 and $35.

Bidder.	Totals. With 2-ring brick.	With 1-ring brick.	With 30-in. vit. pipe
Hanlon & Knepper, Sioux City, Ia.	$27,594	$27,076	$28,111
J. Kehoe & Co., Des Moines, Ia.	27,688	26,908	26,908
G. J. Baer, Kansas City, Mo.	28,073	27,119	27,901
B. P. Egan, Nebraska City, Neb.	28,500	27,203	28,316
S. Katz & G. R. Crandell, Omaha.	29,137	28,148	28,677
Geo. S. Miller & Co., Ottawa, Ill.	29,327	27,947	29,327
C. A. Olson & Co., Marshalltown, Ia.	$30,186	$29,784	$30,589
Frank McLellan, St. Paul, Minn.	31,340	30,535	31,225
Dubuque Const'n Co., Dubuque, Ia.	31,430	29,912	31,200
B. B. Rourk, Des Moines, Ia.	31,762	31,126	31,161
Wickham Bros., Council Bluffs, Ia.	32,285	31,825	32,400
Kavanagh & O'Connell, Des Moines.	32,736	32,391	32,794
Edwards & Walsh Co., Davenport.	$32,867	$32,234	$32,867
Rockford Const'n Co., Rockford, Ill.	37,038	36,026	37,119
Porter, Bowlin & Hadley, Tipton, Ind.	38,245	37,279	37,126
Bryan & Youngerman, Des Moines,	49,977	48,367	49,287
King & Kennedy, Des Moines, Ia.	.....	.....	.....
Berry & Welch, Iowa City, Ia.	30,450	.....	.....

ASPHALT AND BRICK PAVING.—Williamsport, Pa.—Local papers state that the following bids were received June 25 and opened by the council July 1 for paving West Fourth St. with asphalt or brick, on 6 ins. concrete foundation, as advertised in Engineering News: For asphalt, Sicilian Asphalt Paving Co., $2.45 per sq. yd. for one year guarantee, or $2.65 with a guarantee for ten years. For brick, Berry & Day, Mack fire clay block, $1.62 for one year guarantee, $1.69 for ten years; Mack shale, $1.63 and $1.70; Mack repressed fire clay, $1.65 and $1.72; Mack repressed shale, $1.67 and $1.74; Mack wire-cut fire clay, $1.54 and $1.61; wire-cut shale, $1.55 and $1.62; Canton Metropolitan block, $1.65 and $1.72; Canton Royal block, $1.68 and $1.75; Guise brick, $1.40 and $1.50; other standard brick, $1.45 and $1.52; Athens Hallwood block, $1.70 and $1.77; Interstate brick, $1.55 and $1.62.

James McCloud & Co., for Mack brick, one and ten years' guarantees, the order being the same as in the preceding bid, $1.67 and $1.77; $1.68 and $1.78; $1.66 and $1.76; $1.67 and $1.77; $1.57; $1.60; $1.71; $1.81; Canton repressed, $1.77 and $1.87; Canton wire-cut, $1.69 and $1.79; Guise brick, $1.54; Townsend block, $1.71 and $1.81.

D. P. Guise bid for his own brick, one year guarantee, $1.55.

Sawders & Houston, Mack brick, $1.88 and $2.08; $1.89 and $2.09; $1.86 and $2.06; $1.87 and $2.07; $1.79 and $1.99; $1.78 and $1.98; Canton brick, $1.92½ and $2.13½; $2 and $2.20; $1.95 and $2.15.

Homer & Co., Olean, N. Y., Mack brick, $1.89 and $1.99; $1.91 and $2.01; $1.89 and $1.99; $1.91 and $2.01; $1.76 and $1.86; $1.77 and $1.87; Canton brick, $1.92½ and $2.02½; $1.99 and $2.09; $1.94 and $2.04. Geo. D. Snyder, Cy. Engr.

DREDGING.—Brooklyn, N. Y.—The following bids were received by the bureau of yards and docks, Washington, for dredging at the Brooklyn navy yard: Wm. H. Beard, New York, 25 cts. per cu. yd.; R. G. & J. S. Packard, New York, 24½ cts.

ASPHALT PAVING.—Indianapolis, Ind.—Bids were received June 22 for paving Massachusetts Ave. with asphalt, 712 x 32 ft., 3,408 sq. yds., on 6 ins. Portland cement concrete, 1,148 ft. of stratified limestone curb, 100 ft. of granite round corners, 2,227 ft. of marginal stone. The Warren-Scharf Asphalt Paving Co. received the contract at $5.56 a lin. ft. of each side of the street. Other bids were $6.80 and $6.87. Also for asphalting part of Fort Wayne Ave., 1,323 x 30 ft., 5,197 sq. yds. of asphalt on 6 ins. of Portland cement Troy Hill road, 2,000 cu. yds. excavation, at 44 cts. per yd.; 4,000 sq. yds. Ligonier block paving, at $1.79 per yd.; 100 lin. ft. new curb, at 48 cts. per ft.; 100 lin. ft. curb reset and redressed, at 18 cts. per ft.; 500 lin. ft. granite crossing, at 70 cts. per ft.; 100 lin. ft. crossing reset and redressed, at 8 cts. per ft.; total, $8,464; also for 2,400 cu. yds. excavation, at 27 cts.; 4,400 sq. yds. Ligonier block paving, at $1.76; 100 lin. ft. curb, at 48 cts.; 100 lin. ft. curb reset and redressed, at 18 cts.; 500 lin. ft. granite crossing, at 70 cts. per ft.; 100 lin. ft. crossing reset and redressed, at 8 cts. per ft.; total, $8,816; also for repaving portion of Lowrie St., 4,000 cu. yds. excavation, at 26 cts.; 7,400 sq. yds. Ligonier block paving, at $1.80; 100 lin. ft. new curb, at 48 cts.; 100 lin. ft. curb reset and redressed, at 18 cts.; 500 lin. ft. granite crossing, at 70 cts.; 100 lin. ft. crossing reset and redressed, at 8 cts.; total, $15,450. Harvey Sloan, repaving Charles St., 5,600 cu. yds. excavation, at 30 cts.; 10,500 sq. yds. Ligonier block paving, at $1.90; 100 lin. ft. new curb, at 50 cts.; 100 lin. ft. curb reset and redressed, at 20 cts.; 1,000 lin. ft. granite crossing, at 75 cts.; 100 lin. ft. crossing reset and redressed, at 20 cts.; total, $22,470; also for repaving Chestnut St., 2,300 cu. yds. excavation, at 50 cts.; 4,300 sq. yds. granite block paving, at $2.70; 100 lin. ft. new curb, at 50 cts.; 100 lin. ft. curb reset and redressed, at 20 cts.; 500 lin. ft. granite crossing, at 70 cts.; 100 lin. ft. crossing reset and redressed, at 20 cts.; total, $13,200. A. V. Purnell, repaving Federal St., 3,000 cu. yds. excavation, at 5 cts.; 5,500 sq. yds. Ligonier block paving, at $2; 100 lin. ft. new curb, at 57 cts.; 100 lin. ft. curb reset and redressed, at 27 cts.; 1,000 lin. ft. granite crossing, at 60 cts.; 100 lin. ft. crossing reset and redressed, at 5 cts.; total, $11,839.

PAVING BRICK.—Wilmington, Del.—The following bids were received July 1 for furnishing 30,000 sq. yds. of vitrified brick or blocks, the brick to be not less than 8 ins. long, 2½ ins. thick and 4 ins. deep: John Jacoby, Wilmington, Del., No. 6 iron shale, repressed, $1.03 per sq. yd.; No. 4 do., wire cut, 99 cts.; No. 5 round corner repressed clay, $1.01; No. 3 wire cut clay, 97 cts.; McMahon & Porter's repressed clay, $1.07; Globe repressed blocks, $1.07; do. standard, $1.02; do. repressed bricks, $1.07; Vulcan standard, $1.02; Kounts wire cut shale, 98½ cts. John M. Mack, 1345 Arch St., Philadelphia, standard vitrified fire clay bricks, 93 cts.; repressed fire clay or shale vitrified bricks, $1.02; Mack fire clay blocks, $1.03. Francis & Rauch, Pine Grove, Schuylkill county, Pa., straight edge brick, shale, 70 cts., round edge brick, shale, 70 cts. South $11,000 for the sheathing, $1.45 for stone and $38,000 for the entire work. Edward P. Champlin, Clk.

SEWERS.—Iowa City, Ia.—The contract for constructing the Market Run sewer has been awarded to Horrabin & Rourk, their bid being the lowest when the probable amount of concrete was considered. The sewer will be 2-ring brickwork, plastered on the inside with a ½-in. coat of Portland cement plaster (1 to 1), on the outside with a ½-in. coat of cement mortar; 10 courses of the outside ring and 17 of the inside to be laid in Portland cement mortar; approximate average depth of excavation, 9 ft.; Charles S. Magowan, Cy. Engr.:

Bidder.	Sections A.[1]	Sections B.[2]	Sections C.[3]	Timber, M. ft. Trenches.	Timber, M. ft. Foundations.	Concrete, cu. yd
Berry & Welch, Iowa City, Ia.	$2.90	$3.37	$3.24	$18	$18	$5.00
Horrabin & Rourk, Iowa City.	2.83	3.44	3.29	18	18	4.00
G. Graef & Son, " "	3.45	3.80	3.60	15	15	3.20
Edwards & Walsh Davenport,	3.20	3.95	3.90	15	20	6.00
Dubuque Const'n Co. Dubuque,	2.60	4.20	4.00	20	20	3.50
Becky & Hayde, Muscatine, Ia.	3.29	4.26	4.23	20	20	5.00
Murray Bros., Cedar Rapids, Ia.	3.35	4.55	4.20	10	25	5.50
D. Stephens, Rock Island, Ill.	3.75	4.60	4.10	15½	15½	5.50

[1] About 200 ft. of 2 x 3-ft. egg-shaped sewer, per lin. ft. [2] About 1,428 ft. of 4-ft. circular sewer, per lin. ft. [3] About 950 ft. of 3½-ft. circular sewer, per lin. ft.

WATER-WORKS.—Wapakoneta, O.—Geo. Hornung, Consult. Engr., Arno Bldg., Cincinnati, has sent us a statement of the bids received June 25 for constructing water-works, as advertised in Engineering News. The contract for two horizontal compound duplex pumping engines was awarded to the John H. McGowan Co., of Cincinnati, at $3,980, the other bids being H. R. Worthington, $4,218; Stilwell-Bierce & Smith-Vaile Co., $4,528; Hughes Steam Pump Co., $5,200; Laidlaw-Dunn-Gordon Co., $4,675. Contract for water tower was awarded to the Brownell Co., at $7,330, the L. Schreiber & Sons Co. bidding $11,332. Contract for pump house, receiving well and pumping engine foundations was awarded to Newmeyer & Zieglfelder, of Wapakoneta, at $4,118, the other bids being Duemer & James, Hamilton, O., $5,300; Desermou & Co., Springfield, O., $4,118; A. N. Andrews, Hamilton, O., $4,300; Mansfield & Allen, Indianapolis, Ind., $4,170; Shaw, Kendall & Co., Toledo, O., $4,300; Wintz & Still, Wapakoneta, O., $4,300. The bids for 74 tons of

12-in. pipe, 92 tons of 10-in., 64 tons of 8-in., 581 tons of 6-in., and 174 tons of 4-in. pipe, and 22 tons of special castings, were as follows:

	Pipe.	Specials.	Total.
J. B. Clow & Sons, Chicago, Ill.	$22.50	$50.00	$23,282
Lake Shore Foundry, Cleveland, O.	21.40	45.00	22,069
Anniston Pipe&Fdry Co., Anniston, Ala	20.30	45.00	20,985
Addyston P. & S. Co., Cincinnati, O.	20.80	.....	.....
*Mich. Peninsular Car Co., Detroit.	19.60	45.00	20,296
Snyder & Williams, Dayton, O.	20.30	45.00	20,985
Desermou & Co., Springfield, O.	22.00	50.00	22,770
R. N. Andrews, Hamilton, O.	20.30	43.30	20,948
Mansfield & Allen, Indianapolis, Ind	20.30	45.00	20,985
Shaw, Kendall & Co., Toledo, O.	20.80	45.00	21,478
Wintz & Still, Wapakoneta, O.	20.30	45.00	20,985

* Awarded contract.

The bids for water tower foundation were as follows, (1) being price per cubic yard for 375 cu. yds. of earth excavation, (2) for 120 cu. yds. of concrete footing, (3) for 475 cu. yds. of rubble lime and range sandstone masonry:

	Price bid. 1.	2.	3.	Total.
Duemer & James, Hamilton, O.	$0.25	$8.00	$10.00	$5,804
*M. Stopper, Cincinnati, O.	.40	3.95	7.25	4,068
Newmeyer & Ziegfelder, Wapakoneta.	.47	5.25	9.00	5,124
Desermou & Co., Springfield, O.	.47	5.25	9.00	5,124
R. N. Andrews, Hamilton, O.	.40	4.00	7.50	4,192
Mansfield & Allen, Indianapolis, Ind.	.40	4.00	7.50	4,192
Shaw, Kendall & Co., Toledo, O.	.40	5.00	9.00	5,025
Wintz & Still, Wapakoneta, O.	.25	5.05	7.65	4,093

* Awarded contract.

Bids Received for Fire Hydrants, Valves and Valve Boxes for Wapakoneta, O., Water-Works.

Bidder.	Fire hydrants, 106.	Valves, each. 16-in., 1.	12-in., 7.	10-in., 6.	8-in., 6.	6-in., 138.	4-in., 58.	Extension valve boxes.	Total.
J. B. Clow & Son, Chicago, Ill.	$25.50	$61.25	$32.00	$22.50	$16.35	$11.15	$7.05	$2.75	$5,551
Bourbon Copper & Brass Works, Cincinnati, O.	27.00	52.40	27.00	20.40	15.00	9.60	6.15	2.30	5,474
R. D. Wood & Co., Philadelphia, Pa.	25.00	55.00	30.00	23.00	17.00	11.00	6.50	2.50	5,590
Crane & Co., Chicago, Ill.	26.00	55.00	26.00	21.50	15.50	8.75	5.90	2.40	5,324
*Michigan Brass & Iron Works, Detroit, Mich.	22.85	55.00	29.00	22.00	15.50	10.00	6.20	2.50	5,267
Ludlow Valve Mfg. Co., Troy, N. Y.	21.88	53.30	28.30	22.32	15.57	10.30	6.20	2.75	5,173
Rensselaer Mfg. Co., Troy, N. Y.	.....	50.00	26.00	20.60	14.00	9.00	5.80	2.00	2,450

* Awarded contract.

Bids Received for Laying Water Pipe, Setting Fire Hydrants, Etc., for Wapakoneta, O., Water-Works.

Bidder.	Pipelaying. 12-in., 1,860 ft.	10-in., 2,900 ft.	8-in., 2,820 ft.	6-in., 33,700 ft.	4-in., 5,220 ft.	Setting hydrants, 106.	Total.
John W. & Joseph Karsch, Celina, O. (informal)	.....	.....	.....	.....	.....	.....	.....
Duemer & James, Hamilton, O.	$0.27	$0.23	$0.20	$0.15	$0.14	$3.00	$9,237.00
Carruthers & Crane, Newport, Ky.	.24	.22	.16	.15½	.13½	1.25	8,898.30
H. Merigold, Lima, O.	.20½	.18½	.16½	.13	.11	2.00	7,550.30
James Kinsey & Co., Fortoria, O.	.27	.24	.18	.17½	.13½	4.50	10,135.00
Louis Mayer, Lancaster, O.	.22	.16	.14	.11	.10	.50	6,550.00
R. N. Andrews, Hamilton, O.	.23¾	.21¼	.17	.1387	.11¼	4.00	8,342.65
Snyder & Williams, Dayton, O.	.23	.20	.16	.12⅛	.10	2.50	7,439.96
Desermou & Co., Springfield, O.	.22	.19	.17	.12	.10	1.60	7,175.20
Mansfield & Allen, Indianapolis, Ind.	.22	.18	.15½	.13½	.12½	5.00	8,350.30
Shaw, Kendall & Co., Toledo, O.	.25	.22	.17	.13	.11	5.00	8,167.60
*Wintz & Still, Wapakoneta, O.	.20	.18	.15	.10	.10	.40	6,271.40

* Awarded contract.

CAST IRON PIPE.—Afton, N. Y.—P. A. Hayes, Secy., writes us that the contract for hydrants and valves for the water-works has been awarded to the Eddy Valve Co. at $957, and that for pipe to Jackson & Woodin, the bids for pipe being as follows.

	8-in.	6-in.	4-in.	Specl.	Total.
Pancoast & Rogers.	$20.82	$20.82	$21.22	$0.023	$10,784
Jackson & Woodin	20.40	20.40	21.20	.02	10,583
R. D. Wood & Co.	22.00	22.00	22.50	.02¾	11,398
Warren Foundry Co.	22.55	22.55	22.55	.0225	10,937
Chas. Millar & Son.	21.75	21.75	21.75	.0225	11,200
Robt. McK. Ackerman	21.50	21.50	22.50	.0275	11,234
Bourbon C. & B. Wks.	20.25	21.00	22.25	.0225	10,880

GRANITE PAVING.—Troy, N. Y.—The contract for paving the roadway and approaches of the Spring Ave. bridge has been awarded to Casey & Cavanaugh, at $2.40 per sq. yd. for granite blocks on concrete, or $2.30 on sand foundation; 70 cts. per lin. ft. for bridge stone; 75 cts. per lin. ft. for curbing, and 35 cts. per sq. yd. for flagstone.

METAL MARKET PRICES.

LEAD.—New York: 3.3 to 3.5 cts. Chicago. 3.1 to 3.2 cts. St. Louis: 3.05 to 3.12 cts.

BARB WIRE.—Pittsburg: $2 for galvanized and $1.30 for plain in carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $12.40 to $14. Pittsburg: $11.50 to $13.65. Chicago: $11 to $13.50.

TRACK MATERIAL.—New York: angle bars, 1.4 to 1.45 cts.; spikes, 1.75 to 1.85 cts.; track bolts, 2 to 2.1 cts. with square, and 2.1 to 2.2 cts. with hexagon nuts. Chicago: angle bars, 1.45 to 1.55 cts.; spikes, 1.8 to 1.85 cts.; track bolts, 2 to 2.1 cts., with hexagon nuts.

NAILS.—Pittsburg: $1.55 per keg for carload lots and $1.65 for less than carload lots, for wire nails at mill; $1.30 and $1.35 for cut nails at mill. Chicago: $1.7 and $1.8 for wire nails, $1.45 and $1.55 for cut nails. New York: $1.7 and $1.8 for wire nails, and $1.45 and $1.6 for cut nails.

RAILS.— New York: $24 at eastern mills and $24.75 at tidewater; old rails, $13 to $13.50 for iron, and $10.50 to $11 for steel; light rails, $24; girder rails, $26. Pittsburg: $22 for standard sections of 45 lbs. and over; $23 for light sections; old rails, $12.50 for iron and $10 for steel. Chicago: $25 to $27 for standard sections; $25 for light sections; old rails, $13 to $14 for iron and $8.50 to $12 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.65 to 1.75 cts.; channels, 1.65 to 1.75 cts.; angles, 1.5 to 1.6 cts.; tees, 1.75 to 1.8 cts.; universal mill plates, 1.65 to 1.75 cts., steel plates, 1.85 to 1.7 cts. for tank, 1.75 cts. for shell, 1.85 to 1.9 cts. for flange, 2 cts. for ordinary firebox, 1.85 cts. for locomotive firebox. Pittsburg: beams, 1.5 to 2.1 cts.; channels, 1.5 to 2.1 cts.; angles, 1.35 to 1.4 cts.; tees, 1.5 to 1.6 cts.; Z-bars, 1.5 to 1.6 cts.; universal mill plates, 1.5 to 1.6 cts.; steel plates, 1.4 to 1.45 to 1.6 cts. for tank, 1.55 to 1.7 cts. for shell, 1.65 to 1.8 cts. for flange, 2 cts. for ordinary firebox, and 2 to 4 cts. for locomotive firebox. Chicago: beams, 1.7 to 1.8 cts.; channels, 1.7 to 1.8 cts.; angles, 1.6 to 1.7 cts.; tees, 1.75 to 1.85 cts.; universal plates, 1.75 to 1.85 cts.; steel plates, 1.75 cts. for tank, 2.1 cts. for flange, 2.25 cts. for ordinary firebox and 4.75 for locomotive firebox.

INDUSTRIAL NOTES.

THE MACOMB SEWER PIPE WORKS, of Macomb, Ill., were destroyed by fire July 3, involving a loss of $75,000.

THE MEMPHIS CAR & FOUNDRY CO., of Memphis, Tenn., has an order for 200 furniture cars for the Southern Ry.

THE CONSOLIDATED STEEL & WIRE CO., of Pittsburg, Pa., will start up its Braddock mill, in which considerable improvements have been made.

THE MERCHANTS' DISPATCH TRANSPORTATION CO., of Buffalo, N. Y., will build new car shops at Depew, N. Y., and abandon its shops at Rochester.

THE LANG & GOODHUE CO., of Burlington, Vt., has the contract for a water supply at Lake Placid, N. Y., and is putting in a water supply for the sanitarium at Saranac Lake, N. Y.

EVERSON & LIDDLE, contractors, of Providence, R. I., had a large storage shed burned July 3, involving a loss of $15,000. The building was formerly a car house of the College Hill Cable Ry.

THE WELLMAN STEEL CO., of Thurlow, Pa., successor to the Wellman Iron & Steel Co., will soon start up the works at Chester, Pa., and is reported to have a number of orders on hand. Pres., William Burnham; Secy., D. G. Stokes.

THE NEWPORT NEWS SHIPBUILDING & DRY DOCK CO., of Newport News, Va., has a contract for a steel steamer for the Cromwell Line, to carry passengers and freight between New York and New Orleans. The vessel will cost $500,000.

THE BROOKS LOCOMOTIVE WORKS, of Dunkirk, N. Y., has an order for five ten-wheel engines for the Chicago, Rock Island & Pacific Ry. They will have driving wheels 5 ft. 3¾ ins. diameter, cylinders 19 × 24 ins., and will carry 180 lbs. boiler pressure.

THE AMERICAN BALL NOZZLE CO., of New York, has orders for fire protection and lawn sprinkling nozzles for the government, the latter being used for public grounds and the National Cemetery at Washington. They are also to be tested for spraying disinfectants at hospitals and quarantine stations.

THE GILBERT CAR WORKS, of Green Island, N. Y., was sold at auction by the receiver, at Troy, N. Y., on July 2, and was bought in for $72,000 by the Atlantic Trust Co., of New York, which had a mortgage of $79,000 on the plant. The estimated value of the works is said to be $400,000.

HILL & ENRICHT, civil and consulting engineers, of Chicago, Ill., have been engaged to prepare plans and specifications for water-works at Genoa, Ill.; and for water-works, sewers, and paving at Grossdale, Ill. The firm designed the water-works at Maywood, Ill., for which contracts have recently been let.

THE E. P. ALLIS CO., of Milwaukee, Wis., has an order for a compound duplex blowing engine for the Sloss Iron & Steel Co.'s plant at Birmingham, Ala. It will have steam cylinders 42 × 60 ins. and 76 × 60 ins., and two blowing cylinders 76 × 60 ins. The Reynolds valve gear and air valves will be used.

THE SAFETY CAR HEATING & LIGHTING CO., of New York city, has brought a suit against the firm of John Williams, lamp manufacturers, of New York, for alleged infringement in the manufacture of what is known as the "Gordon & Mitchell" lamp. Messrs. Frederick H. Betts and Elihu Root have been retained by the Safety company as counsel.

THE MOORHEAD, McCLEANE CO., of Pittsburg, Pa., had its iron works and plant sold at auction by the sheriff recently, for $11,000, to the New York Life Insurance Co., which holds a mortgage on the property, which includes 10½ acres of land, five sheet iron mills, two plate mills, the Soho blast furnace, a foundry, machine shop, etc. The works were started in 1857, and are considered to be now worth nearly $1,000,000.

THE WESTINGHOUSE ELECTRIC & MFG. CO., of Pittsburg, Pa., states in its annual report that business has been very good and that the outlook is very encouraging. The new works at East Pittsburg are now completed and in operation. In railway work, the company has equipped a short branch of the Pennsylvania R. R., and is perfecting the conduit electric system of the Electro-Magnetic Traction Co., and multiphase motors for elevated railways.

THE UNITED STATES WIND ENGINE & PUMP CO., Batavia, Ill., has recently been awarded contracts for complete water supply systems at Menominee, Wis.; Dayton and Montezuma, Ia.; Lanark, Ill., and several other towns. It reports a decided increase in the demand for goods in its railway department. It has recently booked orders for cypress tanks to be erected on steel towers for the Pittsburg Junction R. R., at Pittsburg, Pa., and the Illinois Central R. R., Chicago.

THE DE LA VERGNE REFRIGERATING MACHINE CO., of New York, N. Y., announces that it has created a special oil engine department, under the management of Mr. Geo. Richmond, M. Am. Soc. M. E., for putting on the market the Hornsby-Akroyd safety oil engine, under an exclusive license for the United States. This oil engine was selected after an exhaustive investigation and trials extending over nearly a year. It has had a marked success in Europe, taking both the first prizes at the last Royal Agricultural Show in England. It is being built simultaneously in England, Germany, France, Russia and Belgium, and it is expected to be very successful in this country on account of its simplicity, safety and economy.

THE NEW YORK AIR-BRAKE CO., of New York, N. Y., informs us that it has received orders from the Missouri, Kansas & Texas Ry. for 2,000 sets of freight car brakes for the new cars now being built by the Madison Car Co. and the Missouri Car & Foundry Co., and an order from the Great Northern Ry. for 750 sets of freight car brakes for the cars being built by Haskell & Barker, of Michigan City, Ind. The 17 locomotives under construction by the Brooks Locomotive Works for the Great Northern Ry. are being equipped with the New York engine and tender equipments complete, including driver brakes. A force of 250 men is now at work at the company's shops at Watertown, N. Y. At the annual election of the company on June 21 the following officers were elected: Pres., Charles A. Starbuck; Vice-Pres., Hon. D. Magone; Secretary and Treasurer, John C. Thompson.

NEW COMPANIES.—Chicago Pipe Line Service Co., Chicago, Ill.; $2,000,000; John McElligot, Paul Mueller and C. F. Roberts.

American Pump Co., Chicago, Ill.; $45,000; C. C. Hill, H. E. Schrader and B. W. Cummilus.

New Castle Asphalt Block Co., Pittsburg, Pa.; $80,000, with $8,000 paid in; Treas., Wm. C. McElheny.

Anti-Friction Sheave Co., New York, N. Y.; $30,000; W. H. St. John and W. A. Hollman, of Brooklyn, N. Y.

United States Nut Lock Co., Pittsburg, Pa.; $5,000; Treas., Thomas R. Head, 239 Locust St., Allegheny, Pa.

Standard Structural Co., New York, N. Y.; $25,000; P. Minturn Smith, Wm. M. Daniell and Charles Tremain.

E. & B. Holmes Machinery Co., Buffalo, N. Y.; $100,000; Edward Holmes, Britain Holmes and W. B. Cook.

Seattle Warehouse & Terminal Co., Seattle, Wash.; $150,000; T. R. Shepard, H. B. Huntly and John Thomas.

New Castle Tube Co., New Castle, Pa.; $100,000, with $10,000 paid in; seamless tubes; Treas., D. C. Wallace.

High Ore Gold Mining & Smelting Co., Spokane, Wash.; $500,000; Cyrus Happy, W. G. Estep and H. L. Rodgers.

West Penn Oil Co., Fairmont, W. Va.; $500,000, with $500 paid in; O. S. McKinney, John A. Clark and H. J. Price.

Standard Railway & Farm Fence Co., Joliet, Ill.; $100,000; Wm. B. Ridgeley, Charles Fetzer and G. J. Bellersheim.

National Wood Vulcanizing Co., New York, N. Y.; $50,000; R. A. Rutherford, Louis H. Boynton and Alfred H. Byrd.

Weleker-Allen Water Elevator Co., Chicago, Ill.; $5,000,000; William Wedemeyer, James S. Lee and James Hannerty.

McMichael & Wildman Mfg. Co., Norristown, Pa.; $100,000, with $10,000 paid in; iron and steel; Treas., Frank B. Wildman.

Cyclone Furnace Co., Keyport, N. J.; $1,000,000, with $1,000 paid in; John H. Betts, Robert B. Carsley and Converse L. Lindsay.

The Tower Co., Chicago, Ill.; $800,000; to erect a steel tower 1,000 ft. high; David B. Proctor, B. F. Hill and Louis Armstrong.

Lee Construction Co., New York, N. Y.; $200,000; fireproof floors, walls and roofs; Thomas A. Lee, Wm. H. Scanlon and T. Foster Gaines.

Cope Whitehouse Drainage Canal & Reservoir Co., Chicago, Ill.; $5,000,000; Frederick Cope Whitehouse, L. C. Germann and Henry A. Gardner.

Inman Terminal Railway & Dock Co., Houston, Tex.; $100,000; to build docks at Texas City, etc.; S. K. Dick, A. L. Nelms and T. E. Edmondson, all of Houston.

Carbide Mfg. Co., Camden, N. J.; $1,000,000, with $1,000 paid in; calcium, carbide, etc., for light, heat and power; James Donnelly, Camden, N. J.; Charles C. Adams and Wilbur L. Stanger, Philadelphia, Pa.

A WISE CONCLUSION.

1413-1417 Chamber of Commerce,
Chicago, July 6, 1895.

Gentlemen:

We have concluded hereafter always to advertise our lettings in the Engineering News, as we find we have received more bids from an advertisement in your paper than any other publication.

Yours truly,
Hill & Enricht,
Civil and Consulting Engineers.

MORE THAN 150 REPLIES were received, an engineer writes us, from a recent insertion of a water-works advertisement in Engineering News.

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